FALL 1982

NAVY CIVIL Engineer

Sphere study enters final phase at NCEL

Are attitudes changing about mini-computers?

Son becomes CO of dad's WWII battalion

An exotic assignment: The Geibel family learn about Saudi Arabia

What you don't know and should know about 'PUF'

Increasing numbers of lady engineers — military and civilian — are doing significant jobs for the Navy. Lucy Bottomley is one of them. She reports on dangerous underground hazardous spills on page 2.

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THE COVER

The cover of this issue is dedicated to the growing number of lady engineers — both military and civilian — who are making significant contributions to the Navy cause. Lucy Bottomley, of the Naval Air Engineering Center, Lakehurst, NJ, is one such person and is pictured on the cover. With the Navy only three years, she has already been named Woman of the Year — 1981; nominated for the DODs 1981 environmental award; and is a candidate for the 1982 Federal Environmental Engineer of the Year Award. At NAEC, Bottomley's work in solving the pollution problems of Pine Lake and the safe disposal of 20 years accumulation of waste has brought more recognition than she modestly cares to have. (Photo by PH2 Alan Wright of the NAEC Photo Lab)

Navy Civil Engineer

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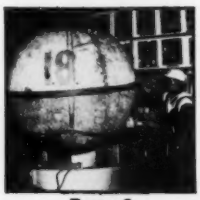

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NEW COVER LOGO

This issue features a new logo on the cover. The words "Navy Civil Engineer" are the same, but the logo design is new. The new logo was designed by staff artist Joy Ardalan. You may notice that it is bolder than before. That is to reflect the pride we have in the magazine. We hope you like it!

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". . . valuable lessons were learned about fuel recovery operations . . . the data gathered from this experience will facilitate future groundwater cleanups."

Handling underground fuel oil spills

(Not an easy task)

By LUCY BOTTOMLEY
P.E., Wisconsin
Environmental Engineer
Naval Air Engineering Center

Author Bottomley (left) is joined by her supervisor James A. Gardener, while working on a pollution study at a local river.

• Lakehurst, N.J.

On September 25, 1981, the Naval Air Engineering Center (NAVAIRENGCEN) at Lakehurst, New Jersey, had a serious underground spill of jet fuel (JP-5) during a routine transfer between two underground storage tanks. The accident caused an initially estimated 3,000 gallons of the fuel to spill into a nearby dry well.

The primary danger of such a spill is potential contamination of groundwater by the seeping fuel mixture, making the water unfit for human consumption. This danger is especially significant at Lakehurst, since the NAVAIRENGCEN is located in the Pineland Preservation Area in southern New Jersey.

The Pinelands are a delicately balanced ecological area where unconsolidated sands contain the largest potentially unpolluted groundwater aquifer in the northeastern United States. This aquifer contains more than 17 trillion gallons of water and is equivalent to a 2000-square-mile by 37-feet-deep lake.

The aquifer is recharged mainly by rainfall, which is easily absorbed by the area's permeable sandy soils. However, the same soils also rapidly transport foreign substances, such as fuel, to the aquifer with little filtering action, and the aquifer is therefore extremely vulnerable to contamination. Furthermore, the hydrology of the acquifer is such that, once it becomes contaminated, the water may not be potable again for decades or even centuries. Therefore, it is vitally important to deal with spills immediately and properly. Both the technical and administrative/legal requirements for successful cleanup of toxic spills and prevention of extensive groundwater contamination will be discussed.

Detection of the Spill

During a fuel transfer operation at the NAVAIRENGCEN, a manual gate valve, whose lines discharged underground into a dry well, was inadvertently left in a partially open position. As a result, fuel leaked from this valve during the transfer operation. When visual evidence of a fuel leak/spill began to show on the ground surface, the transfer operation was terminated.

Due to the ecologically unique location of the NAVAIRENGCEN, it had been judged necessary to establish an early warning system at potential spill sites such as fuel farms and hazardous waste storage areas. The Environmental Branch of the Center's Public Works Department was tasked with establishing a network of ground monitoring wells on the base. These wells, in addition to serving as an early warning system for groundwater contamination, provided valuable information about the soil makeup, depth, flow, and direction of groundwater at the Center.

Following the leak/spill, routine examinations of these monitoring wells in the immediate vicinity of the affected area indicated the presence of jet fuel floating on the groundwater. By the end of the week, the level of the fuel as measured by the monitoring wells had increased to one foot. These data, along with information gained from fuel farm inventory records including verifying receipts and issue records, confirmed the fuel spill.

Response Action

With any serious accident, several steps must be followed even before major physical action is taken. Specifically, the incident must be reported to the proper authorities; immediate action must be taken to prevent danger to nearby residents and the area; and a remedial plan must be formulated. Immediately after confirmation of the fuel spill, the Commanding Officer was briefed and a coordinated action plan implemented:

- The Commanding Officer immediately telephoned Commander, Naval Base, Philadelphia, and outlined the scope of the spill and the action being taken.
- OPREP-3 Navy Blue Message was sent to notify the Chief of Naval Operations (CNO) of the fuel spill. This report is a mandatory naval procedure when a spill occurs.
- Closed the potable water well immediately adjacent to the spill area to eliminate the possibility of petroleum products entering the drinking water and to prevent pumping action at this well that would have drawn the spilled fuel away from the original site.
- Began daily monitoring of the public drinking water system to detect the presence of hydrocarbons.
- Notified the appropriate Federal, state, and local Governmental agencies, including the U.S. Environmental Protection Agency (EPA), the New Jersey Department of Environmental Protection (NJDEP), and the Pinelands Commission.
- Obtained ad hoc authority for sole-source contract negotiation from Northern Division Naval Facilities Engineering Command (NORTHNAVFACENGCOM) to initiate a contract with a spill cleanup contractor. With this authority, a contract was signed with the New England Pollution Control Company, only five days after the spill was reported.
- Mobilized Public Works employees to be available for any required site preparation or construction.
- Prepared a major event chronological diary of the fuel spill, along with site drawings with accurate locations of fuel farm, monitoring wells, groundwater data, man-made structures, ect.

Once these initial steps had been taken and all the technical and legal requirements for this undertaking were satisfied, actual cleanup of the spill could begin.

Technical Considerations

The Recovery Process

The method of recovering fuel from the underground spill was based on forming a cone of depression. The water table in the area of the fuel spill was lowered by strategically placing a recovery well at the site. Constant pumping of water from below the fuel layer (draw-down pumping) created the cone of depression (see Figure 1). This cone drew the fuel product to a central point of recovery, preventing migration of the fuel and thus minimizing damage. This method kept the recovery costs to a minimum since only one recovery well had to be constructed. ——→

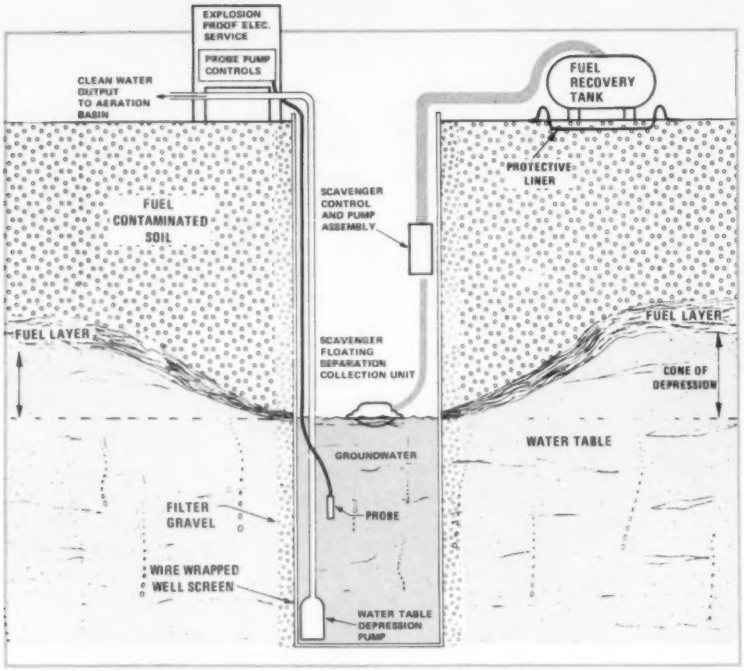


Figure 1. The recovery well showing equipment, piping, and controls for the underground fuel spill. The cone of depression is indicated by arrows.

Once the well was in place and the cone of depression was formed, a fuel-water separator scavenger, manufactured by Oil Recovery Systems, Inc., was placed in the well on top of the fuel layer. The scavenger featured a specially designed and coated Number 60 oliphilic/hydrophobic filter cartridge mounted in a floating collection unit. This unique filter rejected water but allowed oil products to pass through to the collection bowl.

From there, the fuel was automatically pumped to a recovery tank at a rate of up to five gallons per minute (gpm). The recovered fuel was virtually 100 percent water-free, and was used by the local Firefighting School at NAVAIRENGCEN for training.

Figure 1 is a diagram showing the spill recovery equipment, including the well, the scavenger unit, and the drawdown pump, with associated ancillary equipment, piping, and instruments.

The well was installed with an Easy Borebucket auger. The technique employed alternate raising and dropping of the auger and removal of the collected sand. Water was added from a nearby fire hydrant to facilitate bailing of the sand. A Johnson screen was then placed into the drilled hole. The screen was 25 feet long, with a 24-inch inside diameter and a closed steel bottom.

Tight wire wraps extended two feet from the bottom and three feet from the top. There were .050-inch slots in the remainder of the screen between the wire wraps. These slots allowed the flow of fuel and groundwater into the well.

Following the installation of the screen, the annular void was backfilled with a mixture of Number 2 and Number 3 Morie filter gravel to minimize problems of sanding and to improve the water inflow rate. The gravel near the top of the well was sealed with bentonite to prevent infiltration of surface pollutants.

Finally, the well was developed by using the fire hydrant at full force. This was done to unclog silt, sand, or mud from the screen openings created during drilling.

Since oily earth is considered hazardous waste in the state of New Jersey, as in many other states, the spoils from the well installation were placed in open ring top drums for proper disposal by a waste disposal contractor. The draw-down pump used for the operation was a 2-HP water pump with a special probe attachment that permitted automatic pumping of water from the recovery well. The probe was designed to allow pump operation as long as "clean water" (see below) was sensed and to shut off when fuel product was detected.

The pump was capable of conveying water to the discharge pipe at 80 gpm. Figure 1 shows the explosion-proof electrical service that was constructed specifically for the spill site to allow safe operation of all electrical equipment and instrumentation under explosion-prone conditions.

Recovery Well Placement

While the actual mechanism of underground fuel recovery described above was relatively straightforward, determining the actual location for the recovery well was somewhat more involved and of the utmost importance. Indiscriminate and improper placement of the recovery well would have been costly, since additional wells would have had to be installed, and valuable time would have been lost in the process, allowing the fuel to migrate. Therefore a careful evaluation and determination had to be made as to where to locate the recovery well.

The various factors that influenced the decision included the general location of the spill, the location of the underground tanks, the depth and direction of groundwater flow and spill migration, and the expected zone of influence developed by the drawdown pump.

To determine groundwater flow and spill migration, the existing monitoring wells at the site were sampled daily for the presence and/or depth of the fuel layer. To obtain a clearer picture, two additional monitoring wells were placed in the area immediately following confirmation of the spill (see Figure 2).

Data from these wells and from other monitoring wells on the base, and the location of several bodies of surface water nearby, indicated both the depth of the groundwater and its flow direction. The combination of this information with water sample analyses from all potable water wells established the direction of fuel migration.

The zone of influence (the area of groundwater affected by the cone of depression, expressed as the diameter of the top of the cone) is affected by the surrounding soil characteris-

tics, the depth of the recovery well, the capacity of the pump, and nearby underground structures. Soil borings taken in the area showed that the soil in the vicinity of the spill was a homogeneous, gravelly sand that was very permeable and contained no clay lenses.

Such soil conditions allow for free and steady flow of the groundwater and for the establishment of a large cone of depression for a pump of given capacity. The underground storage tanks were the only interference to free groundwater flow, and were expected to cause areas of slower flow.

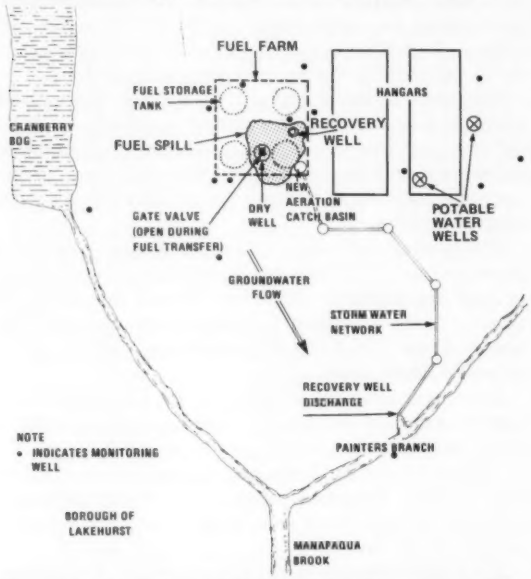


Figure 2. Location of fuel spill with surrounding structures, waterways drainage system, and recovery and monitoring wells.

On the basis of all the monitoring well data and testing results of the groundwater hydrogeology, it was decided to place the recovery well at the point shown in Figure 2. At this location, although it is slightly at right angles to the bulk of the fuel migration, protection of the potable well water was ensured. Furthermore, any random migration of the fuel to below the hangars would be prevented, avoiding more costly recovery methods and adverse impacts on NAVAIRENGCEN operations.

A calculation showed that, with existing soil conditions and an 80 gpm pump, a 12-foot deep well would create a cone of depression with a top diameter of 120 feet. This zone of influence encompassed the shape of the spill, and with this setup, it was expected that practically all of the spilled fuel would be recovered.

Legal Requirements/Ramifications

To comply with the laws and regulations of Federal, state, and local regulatory agencies, several reporting requirements had to be met concerning the fuel spill at the NAVAIRENGCEN. Failure to meet these requirements could have resulted in punitive action. Therefore, in compliance with the requirements, the NAVAIRENGCEN informed all appropriate agencies, including the EPA, NJDEP, and the Pinelands Commission, immediately on confirmation of the occurrence of the spill.

The NJDEP gave the NAVAIRENGCEN a spill incident number and assigned an enforcement officer, who assisted by outlining the necessary state and federal reporting requirements and providing a list of state-approved spill cleanup contractors.

Although the reporting requirements were mostly straightforward, complications and delays resulted from the fact that three regulatory agencies had to be informed and subsequently had to approve each phase of the cleanup operation.

On several occasions, conflicting requirements among statutes of the different agencies were mandated and had to be resolved through NAVAIRENGCEN negotiations.

One incident revolved around obtaining a National Pollutant Discharge Elimination System (NPDES) permit to discharge the water from the drawdown pump into an existing storm drainage system connected to a local body of water, the Painters Branch of the Manapaqua Brook.

The trouble arose from the fact that the "clean water" situated below the fuel layer, and continuously pumped through the discharge pipes to create the cone of depression, was in fact not completely uncontaminated.

On November 16, 1982, after receipt of the "Letter of No Action," from the EPA, cleanup operations began. The state of New Jersey was given cognizance for all regulatory agencies in enforcing the regulations required during cleanup.

Weekly progress reports were sent to all agencies to keep them apprised of the pH, visible foam, floating solids, total organic carbon, petroleum hydrocarbons, and volatile organics present in the effluent discharge.

Fuel Recovery

The two most important factors in the success of the spill cleanup operation were the concentrations of the volatile organics in the recovery well discharge effluent and the amount of fuel recovered. The former ensured compliance with the discharge permit requirements and the latter indicated the progress of the actual recovery. Therefore, both of these factors were closely monitored.

Figure 3 is a plot of the total volatile organics in the effluent at the discharge point, monitored weekly during the

Laboratory technicians join Lucy Bottomley (center) in taking samples of the recovery well.

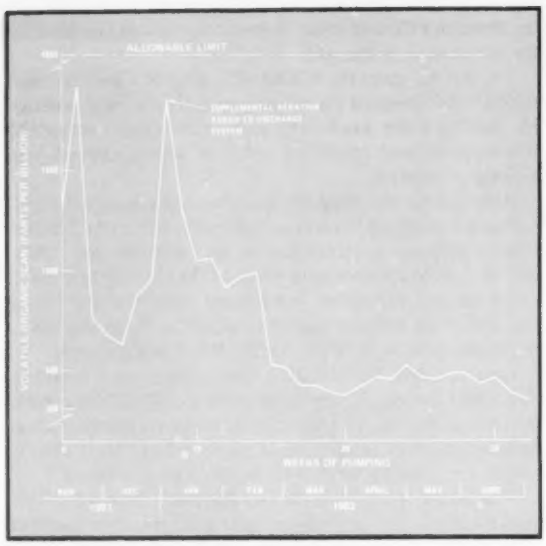


Figure 3. Total volatile organic concentrations in effluent versus weeks of pumping and time of year.

recovery period. It can be seen that in all instances, from the beginning of the cleanup operation, the readings were well below the allowable limits.

During the first week in January, however, a significant increase in volatile organic concentration was observed. Although the increased value was still well below the allowable tolerances, it was disturbing, and methods of reducing the concentration levels were investigated. It was assumed that the increased values resulted from cold weather, which affected the storm drain system.

As the colder temperatures reached the drainage pipe, the volatile organics escaping from the effluent condensed on the discharge line. The condensate redissolved into the waste water stream, and appeared in the effluent at the discharge point.

Instead of installing a costly pretreatment system to purify the effluent, two actions were taken to decrease the volatile organic concentration of the effluent to more acceptable levels.

First, concrete blocks were placed in the storm drain at the manholes; and second, all the manhole covers between the aeration catch basin and the discharge point into the Manapaqua Brook were removed.

The concrete block increased the tumbling and aeration action of the effluent and removal of the covers allowed the volatile constituents to escape. The chart in Figure 3 indicates that these actions decreased the volatile organics in the effluent.

The weekly fuel recovery rates decreased during the winter months to less than 20 gallons per week. This decrease caused some concern, since by that time only 2,000 gallons of fuel had been recovered.

To gain additional information on the cause of this drop in recovery rate, 15 more monitoring wells were installed around the original site of the spill. Their purpose was to obtain data on the presence and depth of the remaining fuel, indications of possible spill migration, and the effect of the existing zone of influence.

Once these data were analyzed, they confirmed the presence of more fuel and showed that the original spill had undergone little migration and had not spread beyond the original zone of influence. Therefore, the slowed recovery rate had to be attributed to some other factor.

The effect of the weather on the recovery rate was analyzed. Air temperature and precipitation data for the region were obtained from the Center's Weather Service. The average weekly temperature and precipitation were plotted.

During January and February, the average daily temperatures were generally below freezing. The colder temperatures caused the soil to freeze and the jet fuel to be more viscous. This situation hindered the easy flow of fuel into the well, and therefore the recovery rates decreased.

They were further decreased because rain and snowfall could not penetrate the frozen ground, and the fuel "locked up" in the soil could not be washed down to the groundwater and subsequently recovered. As the weather became warmer and the ground began to thaw, the recovery rates began to increase steadily.

The data supplied by the additional wells had shown that if the motor size of the drawdown pump were increased from 2 to 3 HP, the discharge rate would increase from 80 to 100 gpm, acceptable effluent volatile organic concentrations would be maintained and the fuel recovery rate would be increased significantly.

The larger pump was installed on the 24th week of the cleanup operation. The recovery rate increased from below 100 gallons per week to 175 gallons per week.

Another unusual fact is the cumulative total of fuel recovered. To date, more than 4,000 gallons of fuel have been retrieved, and recovery is still continuing at the rate of about 100 gallons per week.

Since approximately 3,000 gallons had originally been spilled, some explanation for the discrepancy was sought. Through an investigation of the fuel farm construction and maintenance reports and a literature search on industrial fuel farms, it was learned that fuel-soaked soils around fuel farms are not unusual. For instance, during construction modifications of the present fuel farm, large amounts of fuel-stained soils were uncovered.

Past practices also may have contributed to fuel losses. That is, condensate from the sump pits of each underground tank was pumped to a dry well. During this procedure, some fuel or oil may have been pumped into the dry well along with the condensate.

At present, there is no way of knowing how much fuel was accidentally pumped into these dry wells. Although each incident may not have been significant in itself, the cumulative effect could be substantial, as indicated by the excess amount of fuel now being recovered.

The Future

At the beginning of the cleanup procedure, it was expected that the operation would cease when about 3,000 gallons of fuel had been recovered. Since fuel far in excess of that amount has been and is still being found, the NAVAIRENGCEN has not yet attempted to shut down the recovery operations.

advice of counsel

departments

By WILLIAM H. SPECK
NAVFAC HQ

"The Law must be stable, but it must not stand still" Roscoe Pound

An experienced Justice lawyer was heard to remark: law is just common sense, except when statutes are involved. For statutes dictate according to definitions and grammar, fitfully illuminated by contradictory legislative history, and multiply to necessitate interpretation in relation to each other. Reasonable or unreasonable, wise or unwise, the statutes tailor the cloth of procurement actions.

The Armed Services Procurement Act of 1947 (now 10 U.S.C. 2301) sets forth basic rules for contracting, parallelled by the Federal Property and Administrative Services Act of 1949 for civilian agencies, and substantially amended for negotiation steps by the Truth in Negotiation Act of 1962 (10 U.S.C. 2306(f)).

The liberty to make final decisions binding in law was taken away by the Wunderlich Act of 1954 (41 U.S.C. 321).

The Brooks Act of 1972 (40 U.S.C. 541) preserved old flexibilities in negotiating Architect-Engineer contracts.

The Contracts Disputes Act of 1978 (41 U.S.C. 601) codified in detail the remedies of contractors and the government before boards and in the courts.

The Equal Access to Justice Act of 1980 (5 U.S.C. 504) allowed certain successful plaintiffs and defendants in legal proceedings involving the government to recover attorneys fees if the Government position was not substantially justified.

The proliferation of statutes affecting procurement continues this year. Public Law 97-164, approved 2 April 1982, 96 Stat. 25, establishes a U.S. Court of Appeals for the Federal Circuit with appellate jurisdiction over government contracts, patents and trademarks, trade, and MSPB and a U.S. Claims Court (28 U.S.C. 171).

This Court of Appeals takes review of Government appeals from board of contract appeals decisions and of Claims Court decisions.

The Claims Court has jurisdiction over claims against the Government with the authority "to grant declaratory judgments and such equitable and extraordinary relief as it deems proper, including but not limited to injunctive relief." Equitable relief has been beyond previous Court of Claims jurisdiction.

The Comptroller General may transmit matters to the Claims Court for adjudication. The Act is effective 1 October 1982, and the Claims Court has new rules following those of the district courts.

Public Law 97-177 approved 21 May 1982, 96 Stat. 85, the Prompt Payment Act, requires payment of interest at Treasury rates for bills not paid 30 days after receipt of a proper invoice and requires notice of defects in billings within 15 days.

Public Law 97-214 approved 12 July 1982 is the Military Construction Codification Act, 10 U.S.C. 2801-2861. It modifies and codifies authorization act general provisions and code sections dealing with emergency, contingency and minor construction, architectural and engineering services, military family housing, supervision of construction, cost variations, etc. Much is the same, but much changes.

Handling underground spills

Continued from preceding page

NJDEP has advised the NAVAIRENGCEN that recovery operations may be terminated only when there is no longer any thickness of fuel product on the groundwater as measured through the monitoring wells surrounding the spill site, and when the recovery rate of the fuel has diminished to zero.

The shutdown procedure will be somewhat more complicated than merely shutting off the pumps and backfilling the well. In order to complete the cleanup procedure properly, the zone of influence must be decreased gradually.

More specifically, the drawdown pump at its present capacity has lowered the cone of depression as far as possible in the existing well. When there is no longer any recovery at this depth, the pump will be set to operate at a slightly lower horsepower.

This will raise the cone of depression and saturate soils above the present water table that may still contain fuel product. This process will be repeated at progressively shallower depths until all fuel is recovered.

To prevent the occurrence of similar spills in the future, several steps have been initiated by the NAVAIRENGCEN. All piping in the fuel farm will be placed above ground and cross-connections between tanks will be eliminated. All filters/separators, meters, strainers, relaxation chambers, fuel overfill controls, and associated hardware will be installed in a centralized fuel spill containment.

In addition, the use of all dry wells has been discontinued. These actions will decrease the possibility of unknown fuel losses and facilitate the detection of pipe or valve leaks as soon as they occur. The installation of monitoring wells around the fuel farm will aid in detecting any underground accidents.

Throughout this experience, valuable lessons were learned about fuel recovery operations, including groundwater flow, depth, direction, fuel spill movement, and the effect of temperature fluctuations.

Although it is hoped that such a spill never recurs, the data gathered from this experience will facilitate any future groundwater cleanups from the standpoints of both technical and legal requirements. □

Concrete studies near end at NCEL

Durability tests in water = positive results

By JERRY THOMAS
Naval Civil Engineering Laboratory

• Port Hueneme, Calif.

Two spheres and other concrete specimens were retrieved this year from the ocean off the Ventura County coastline and returned to the Naval Civil Engineering Laboratory (NCEL) Deep Ocean Laboratory for mechanical and physical testing. This marks the final phase of an extensive 10-year, at-sea, study of deep ocean concrete structures by NCEL.

Authorized by the Naval Facilities Engineering Command (NAVFAC), under the sponsorship of the Navy's Deep Ocean Technology (DOT) project, the study involving 18 concrete spheres represents the Laboratory's latest contribution to concrete technology.

The recoveries brought to the surface answers to three important technical questions. Will concrete continue to maintain its strength while subjected to the severe pressures of cold, chemically-active seawater for many years? How watertight is concrete? How durable is concrete in a deep ocean environment?

The results of the ocean exposures and associated laboratory tests corroborated the Navy's contention that concrete is an excellent material for deep ocean construction.

NCEL started the program in September 1971, when it deployed 18 concrete spheres in water depths ranging from 1,800 to 5,000 feet. Each specimen, 66 inches in diameter with four-inch thick walls, was anchored to the seafloor by the 2,600 pound weight of a 2¼-inch anchor chain 53 feet long.

Some spheres were coated with a waterproof phenolic material. Others remained uncoated. Two spheres had one-half of their surfaces coated and were the only specimens to contain steel reinforcement bars. Although the steel doesn't add to the concrete strength in this instance, engineers wanted to study the reaction of steel to the seawater environment.

Examination of one of these spheres, recovered this year after 10 years at a depth of 1,800 feet, revealed no visible corrosion to the steel although in some areas of the model the steel had less than one inch of concrete cover. Nor was there visible deterioration of the concrete material itself in any of the five spheres and blocks retrieved to date.

The long-term study revealed that concrete, coated or not, is highly resistant to water penetration. The amount of water intake was determined in two ways. One was by annual inspections of the spheres in place, and the other by measuring the water found in the recovered spheres.

As the concrete of a submerged sphere absorbs water, the model gains weight, loses buoyancy, and thus supports less of the weight of the heavy anchor chain. Accordingly, to determine water intake, observers in manned submersibles simply counted the number of chain links remaining between the sphere and the seafloor.

Annual chain count observations indicated that the coated spheres absorbed little water, and as expected, the uncoated spheres absorbed more water. In fact, small amounts of water permeated entirely through the uncoated concrete wall into the sphere's interior. This was corroborated by the recovered spheres.

Two coated spheres, retrieved in 1977 after five years at depths of 2,630 and 3,140 feet, did not have any free water inside. An uncoated sphere, recovered at the same time, contained nine gallons of water (2% of the interior volume).

The uncoated sphere retrieved this year from a depth of 3,200 feet contained about 14 gallons of water. The half-coated sphere held only three gallons of water after recovery from a comparatively shallow depth of 1,800 feet.

Robert Rail, NCEL project engineer, pointed out that these calculations represent a slow rate of permeation. Although the uncoated concrete was not "perfectly watertight" on the average only approximately one or two tablespoons of water per day were forced through the concrete to the interior by the hydrostatic pressure. Variations of water penetration can be attributed to differences in ocean depth, to length of exposure and to the percentage of the surface that was coated.

One major objective of the study was to obtain data on changes, if any, in the strength of concrete after it had been exposed to the high pressure, cold (40°F) ocean environment for extended periods of time. Rail said the results have provided information applicable to the design of concrete structures in the ocean.

As a rule the strength of concrete increases with age. But the percentage of that strength-increase is lessened each year as aging occurs. For example the compressive strength of control specimens that were fog-cured for one year at atmospheric pressure and 70°F temperature increased 20% over the baseline strength of 28-day-old fog-cured specimens (nominally 8,000 psi). Five-year-old fog-cured replicate specimens were 35% stronger than the baseline, as were also the 10-year replicate specimens.

In comparison concrete exposed in the ocean for five years showed a compressive strength increase of 15% to about 9,100 psi. Tests after 10 years of ocean exposure found the strength to still be the same.

The conclusion, engineers explain, is that concrete gained considerable strength during the first several years in seawater and retained that strength under continuing high pressure although the concrete did not become as strong as the control specimens cured continuously under favorable laboratory conditions.

Rail said all 18 spheres were designed for a nominal working depth of about 3,000 feet, 1,300 psi. As anticipated some models placed at deeper levels failed. Greater pressures crushed specimens at depths of 3,700 and 5,000 feet.

Three-man Navy submersibles performed the annual inspections. The subs, Seacliff and Turtle, are owned and operated by the Navy's Submarine Development Group I, San Diego. The Seacliff attached retrieval lines to the three spheres recovered in 1977. The Turtle participated in this year's operations.

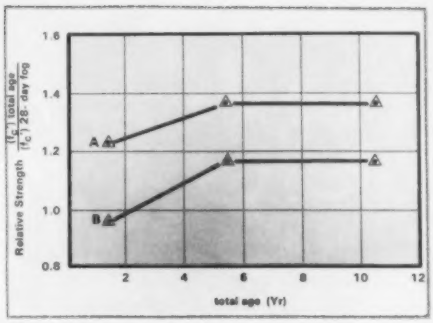
In each recovery dive a reel of braided nylon half-inch rope was attached to the bow of the submersible. An external manipulator held a large steel hook connected to the end of the rope. When the hook grabbed the chain, the sub started to surface, paying out the nylon lifting line. At the surface the line was buoyed with the marker.

The NCEL Offshore Research Craft (ORC) then winched in the line and the sphere surfaced easily. A special wire-rope sling designed by lab personnel was placed around the models for safe transfer from the water to the deck of the ORC.

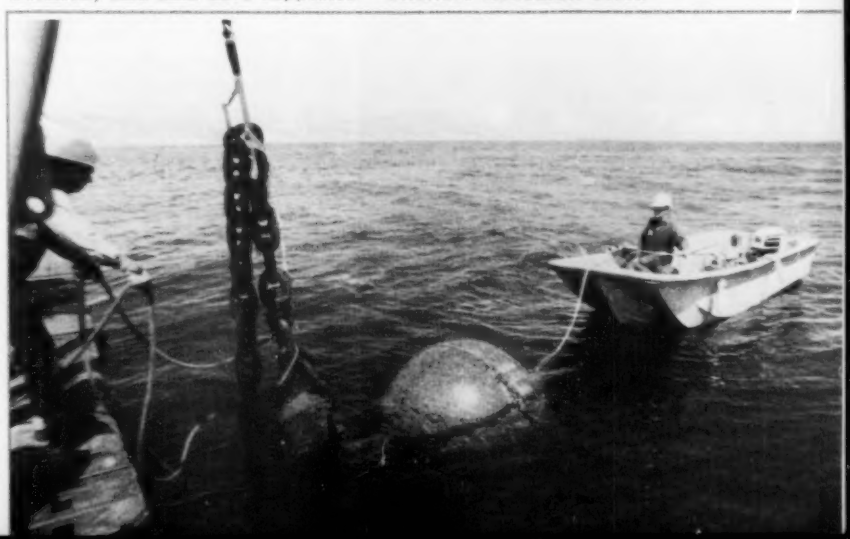
Once aboard the spheres were wrapped in wet burlap and plastic sheets to keep the models damp while being transported to NCEL for laboratory tests.

Technology developed by NCEL will permit the design and fabrication of military concrete structures in the ocean. Dr. W. J. Nordell, director of the Laboratory's Ocean Structures Division, said data have supported studies by the Navy and the Department of Defense of ocean-basing systems, offshore airfields, offshore storage of ordnance at military bases, and submerged fuel storage facilities at advanced bases.

The new technology also can be applied to construction of underwater stations (manned or unmanned) and platforms to accommodate instrumentation and equipment requiring airtight environments. □



***Line A presents the compressive strength gain of concrete exposed to continuous fog curing at 70°F for more than 10 years.**
***Line B presents the compressive strength changes of concrete exposed to ocean curing conditions (hydrostatic pressure & 41°F) for more than 10 years after an initial 28-day fog cure and 2 to 5 months of on-land curing.**
***f_c' at 28 days of fog curing was a nominal 8000 psi.**



A workboat maneuvers a concrete sphere into position for hoist aboard the Laboratory's Offshore Research Craft.

Mini-computers: useful or ?

By LCDR GEORGE N. EUSTACE, CEC, USN
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In 1976, the Director of the Civil Engineering Support Office, Port Hueneme, California, implemented a field test to determine if the minicomputer could be a useful tool within the Naval Construction Force (NCF). The first test indicated that the minicomputer had proven to be useful and capable of providing the battalion with daily information for construction management. Based upon the results of the initial tests performed by Naval Mobile Construction Battalion ONE (NMCB-1) during the Guam deployment, the decision was made to purchase minicomputer systems for each main body deployment site and homeport regiment.

In the six years since the minicomputer first appeared in the NCF, it is logical to expect that the initial test results proved that the minicomputer is assisting battalions in completing their projects faster and more economically.

The current trend seems to indicate that more battalions are reporting less than satisfactory experiences using the minicomputer. As a result of this trend, there is a growing debate on whether the usefulness of the minicomputer justifies the time and costs required to keep it operational.

When viewed closely, it can be seen that the debate is really between two distinct groups: those who have had proper training and who have taken the time to understand the methods and, if necessary, revise and improve them; and those who have not had training or taken the time to develop a practical use for the minicomputer as a construction management tool in the NCF.

There are many different project management software programs for minicomputers on the market and new ones are added daily. A close look at these types of project management programs reveals one key reason why the NCF has had spotted and sporadic success in making proper use of its minicomputer system.

Each of these programs is general in scope, that is, they are written so they can be applied over a wide range of project management situations. This is a key element of their value. None of these programs is written specifically for one company or firm.

Those familiar with computer programs might not buy a software program that didn't have a user's manual. This is good practice, but first, examine most user's manuals that come with software programs.

Each manual only shows the basic types of information that are necessary to use the program. Seldom does the manual present the complete picture by pointing out the weaknesses of the program and the various things a user could possibly do to create problems.

Like the developer's presentation, the user's manual serves only to convince the prospective buyer that the program is easy and can produce 50 different reports, with your choice of 100 items per report. It does not show how the program should be specifically used in the buyer's particular situation to get the job done.

Before the capabilities of the minicomputer can be fully utilized, an implementation plan will need to be developed to put some common sense and forethought into how and by whom the new minicomputer system will be used.

In order to effectively put the new system to work in a particular company, there must be someone available with a thorough knowledge of the company's construction management organization and procedures and the new minicomputer program capabilities, and with the time to sit down to identify and document (user's manual) exactly how the minicomputer should be used.

Once the specific who, what, where, how and when of the minicomputer's use in a particular construction company has been determined, the next step is to provide training.

At this point, the software developer could be contracted to teach a course. Don't be surprised, however, if this training class seems much like the initial sales presentation and doesn't materialize. The reasons are obvious. The software developer is not in the business to train people.

How effective would training by the software developer be? Would the students come away from the "training" absolutely convinced and excited (sold) on the minicomputer and the software's capabilities? Yes!

Would the students know specifically how to use the system to meet the needs of their particular company? No!

If a construction company continued to acquire its training in this way, what would the success rate for the minicomputer be? At the end of five years? Would there be any debate on whether the minicomputer should or should not be used, or whether or not it was effective? If so, who would the debators be?

The answers would depend upon several considerations. Which individuals had received training even if it was expensive and not specific? Among this group, who have taken the time during daily responsibilities to develop practical methods for implementing and using the minicomputer system?

Is the minicomputer an effective and necessary construction management tool for the NCF? A key issue in this debate is whether clear, common-sense direction and effective training were provided to the NCF which would enable them to properly use the system.

Has the NCF been properly trained over the past six years in the practical, down-to-earth, direct and cost effective uses of the minicomputer as a construction management tool for NMCB project planning and execution? Or have we moved too fast?

As one looks back over the history of the minicomputer in the NCF, look closely at the approach taken towards preparing NCF personnel to use the system. The innovative and clever uses developed for using the minicomputer within an NMCB have been found in the field by people who had some knowledge of the program, tried out different methods, and improved upon them over a period of time.

This "university of hard knocks" approach has been painful, however, and not very cost effective in terms of time used and frustration levels reached.

Originally the NCF contracted with the software developer. This was a logical approach, since someone had to learn the capabilities of the program, and time was required before an in-house training program could be developed. Initial plans in 1978 were to incorporate the minicomputer course as the second week of the Seabee Construction Management Course taught at Naval School, Civil Engineer Corps Officers (CECOS).

The commitment and enthusiasm necessary to implement such training, however, were lost as names and faces changed. As a result, training was obtained each year by sole-source contract from the software developer. In fiscal year 1982, the contract was awarded to a firm with good teaching credentials but no prior knowledge of the NCF minicomputer software and hardware and, more importantly, the NCF. The results received from the training were less than desirable.

It is not intended to unduly criticize the firms and people involved that provided the NCF with what training it has received over the last five years. Their efforts have been sincere, but the task of developing and effectively teaching such a course to the NCF is not easy and requires the following items that have never been required or made available.

Curriculum Outlines — To those new to the task of instructing, this item seems like an unnecessary paper drill but when viewed objectively, it becomes a good tool for organizing and documenting a course of instruction. Specifically, a curriculum outline forces the instructor to think through a course and determine several key factors:

- Mission — Why is the course necessary?
- Terminal Objectives — What does the student need to know to be able to carry out the mission?
- Enabling Objectives — What specific skills or items of information must the student possess to meet a particular terminal objective?
- What training equipment and materials are needed?
- Model Schedule — This item will be discussed in more detail later.

Student Guide — For those who have been to CECOS, this is the familiar blue binder which contains the individual topic sheet with the topic objectives, references, texts, and supplemental notes. Whether such an item is useful can be debated. However, I have never seen a student leave one behind.

Schedule — There never seems to be enough time when teaching a class. If there is to be any hope of staying on schedule, available time must be properly alloted to the required topics. When this is not done, some topics are unnecessarily drawn out and others eliminated due to lack of time.

Feedback — In order to revise and improve a course the instructors must have feedback from the students who go forth to put their newly acquired knowledge to work. This prevents the isolation of the "other" world of the classroom from the "real" world of the deployment site. This has not been effectively and consistently done over the years.

Proper Class Composition and Prerequisites — Who should attend the class? Like much of the training in the NCF, where there is no commitment, class composition usually boils down to who is available. What should the people know before coming to the class? In the case of the minicomputer, the students should have some field experience and construction management knowledge.

Tailored Instruction — In a phrase, this means putting the topics where the "rubber meets the road." If it isn't practical and directly applicable it will not be effective. Most Seabees could care less about the history, philosophy, theoretical aspects and big picture. They want to know the down-to-earth things that can make their jobs easier. They want to know how the minicomputer can give them the specific information to answer the questions of the company chief, company commander, operations officer, commanding officer and the regiment. Since the NCF uses a multi-level construction management organization, it stands to reason that if the minicomputer is to be taught, it should be taught at the various management levels. This means that all those above the project manager should be trained but on a different level and with a different emphasis.

User's Manual — To effectively teach and utilize the minicomputer in the NCF, a practical, down-to-earth user's manual is required. It must describe the specific information necessary to run the program in terms that are familiar to the average Seabee. It should have a clear sequence of screen displays with explicit guidance on what can go wrong if you have fat fingers and happen to depress the wrong key. With an effective user's manual that translates the software developer's version into words and terms common to the NCF, the student would have a better understanding of the system as it is taught.

Instructors — What should be the quantity and qualifications of the instructors? They should be experienced in NCF construction management. People who realize there must be an easier way. This is required for teaching Seabees in order to establish creditability.

Individuals familiar with the type of minicomputer training acquired by the NCF over the last six years, will readily see that the training process has lacked each one of these items. As a result, the ability of NMCB personnel to effectively and efficiently use the minicomputer as a construction management tool has not increased and perhaps has actually decreased. □

technical notes

departments

Power cost may be cut in half with Integral Lighting Switches

An integral lighting switch is a switch that is installed inside an individual fluorescent lighting fixture. Wall switches operate all the lighting in a room, whereas integral lighting switches control each fixture independently.

Fixtures can have a multiple-position pull switch or more than one integral lighting switch. For instance, if a three-lamp fluorescent fixture is equipped with two integral light switches, or a multiple pull switch, it can provide four levels of light output: completely off, one lamp on, two lamps on, or all three lamps on. Although these light levels could also be achieved by removing lamps from the fixture, the integral lighting switch has the advantages of being convenient, eliminating the transporting and storage of lamps, and, most importantly, turning off the energy consuming ballast.

When lighting is planned for a room, the designer usually does not know how the furniture will be arranged. As a result, the designer will lay out a uniform lighting arrangement which will provide task lighting levels to all parts of the room. From an energy standpoint this is wasteful when the area per occupant is greater than 50 square feet. Electric costs (and capital costs also) can usually be cut in half by knowledgeable designers when task locations are known.

The next best alternative is to design uniform lighting systems with integral lighting switches. Once furniture is placed or rearranged, lighting affecting non-task areas can be reduced. Lighting over task areas should be adjusted so that reflected glare and associated veiling reflections are reduced. Aesthetics and visual comfort can be improved by installing high cutoff lenses, such as parabolic louvers, that shield direct glare. For new construction, fixtures should be specifield with integral lighting switches. Most fixture manufacturers provide this as an inexpensive option.

Restrictions on the application and installation of integral lighting switches are found in the 1978 National Electrical Code (NEC) and Underwriters Laboratories (UL) Standard UL-57, "Electrical Lighting Fixtures." State and local codes, where applicable, may place other restrictions on the use of integral lighting swtiches. Discussion of code restrictions herein shall not be considered an official interpretation.

NEC article 210-6(a) deals with the maximum voltage to ground of branch circuits. The article indidcates that integral lighting switches used on 277-volt circuits shall *not* be readily accessible. Readily accessible is defined in NEC article 100 as "capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc." There is no restriction on accessibility for integral lighting switches on 120-volt circuits, but some activities may wish to limit accessibility to assigned building energy monitors.

NEC article 410-38(c) covers the mechanical strength of lighting fixtures for canopy switches. The wording is similar to that found in UL-57. Engineers should also refer to the UL standard to gain clearer understanding of the intent of the wording.

Highlights of UL-57, as they relate to integral lighting switches, are given below. In some cases there are exceptions to these rules, so the UL standard should be consulted for more complete information.

- Fixture sheet metal into which the switch will be mounted must be 0.025 inch thick minimum and securely attached to the fixture.
- A pull-type switch provided in a stem-mounted electric-discharge lamp fixture shall be located not more than 3½ inches in any direction from the center line of the stem if one stem is employed. For fixtures supported by more than one stem, the switch shall be located between the two stems or spaced from the center line of the nearest stem a distance not more than one-half the maximum distance between two adjacent stems.
- If the switch has uninsulated current-carrying parts, minimum spacings from these parts to the grounded parts of the fixture shall be as given in Section 22.
- A switch provided for the control of an electric-discharge lamp or lamps shall have a current rating not less then twice the total current rating of the ballast units and other equipment that it controls, or shall be of a type suitable for controlling an inductive load that draws a current equal to or more than such current rating.

Integral lighting switches can provide an effective means of converting uniform lighting systems to task-oriented lighting systems. Some restrictions are imposed by codes and standards which change from time to time; therefore, always consult the latest editions before installing integral lighting switches.

Additional information may be obtained from William Pierpoint, Code L62, Naval Civil Engineering Laboratory, Port Hueneme, CA 93043; Autovon 360-4660, FTS 799-4660, Commercial (805) 982-4660.

NCF tackles the three "Rs"

- RAPID
- RUNWAY
- RECOVERY

By EACS TIMOTHY BUCKLEY, USN

P.E., Calif.

• Port Hueneme, Calif.

Today, more and more is heard about rapid runway repair ("Triple-R") as well as war damage repair and bomb damage repair.

The Naval Construction Force has the knowledge and skill to perform base recovery operations, including rapid runway repair. It must be stressed, however, that war damage or bomb damage repair are not synonymous with rapid runway repair.

Getting the nomenclature in the proper perspective by those doing planning to accomplish rapid runway repair is necessary. It appears also to have confused those planning the P36 component, the component used for rapid runway repair. Consider these definitions of terms:

- Rapid runway repair is expedient repair to a landing strip or runway to make it serviceable for warfare or landing operations. Repairs must be made on site by repair teams immediately after the attack.
- War damage and bomb damage repair are repairs made to base facilities to restore minimum operating capacity to the base and start after runway repairs are underway.

Are the Seabees capable to meet the challenge of rapid runway repair? They are required to get Navy and Marine airfields, whether permanent air facilities or expedient advance bases, back into operation as soon as possible after the attack. Repairs may be performed in areas contaminated by nuclear, biological or chemical agents.

The Seabees have the skill for decontamination and base recovery. This is the ability to make expedient repairs to the base facilities contrary to what has been published. These skills must be combined with the Air Force's technology in rapid runway repair.

The Air Force has "canned" in-house courses to train their Prime Base Engineer Emergency Forces (Prime BEEF) in the art of rapid runway repair.

The Naval Civil Engineering Laboratory (NCEL) at Port Hueneme, Calif., has been monitoring the Air Force research. The Seabees therefore have the skill to perform such repairs.

NCEL monitors the Air Force to ensure they will not duplicate the development of technologies. NCEL developed a fiber-glass-reinforced plastic membrane (Figure 1) which may be used in place of the AM-2 aluminum airfield matting (Figure 2).

The membrane can be used singly or doubly (Figure 1) and has been tested by the U.S. Marine Corps as an expedient surface material for runways.

Test patches of three-eighths inch membrane were subjected to over 1000 simulated C-141 and F-4 aircraft takeoffs and landings, without noticeable damage. The membrane is lighter, thinner (no ramps required) and quicker to assemble. Using the double membrane method, less select fill is required, so more debris (ejecta) can be deposited in the crater (Figure 1).

Rapid runway repair is outlined here with the eight basic steps used by the U.S. Air Force. After the Explosive Ordnance Disposal (EOD) Unit has cleared the area of unexploded ordnance, runway repairs can proceed.

Identify Craters for Repair

"Spalls" are gouges in the surface caused by aircraft cannon fire. They may be patched with cold-laid asphaltic concrete, quick-setting concrete or any number of commercial products such as "Amalgapave" that meet the required specifications.

Small craters are caused by munitions with five to 35 pounds of charge; they are less than three feet deep.

Large craters are caused by munitions with one 100 pounds of charge or more; they are greater than three feet deep.

Establish a Temporary Centerline

Select that portion of runway with the fewest craters to fill. Tactical aircraft have limited fuel supplies; if they

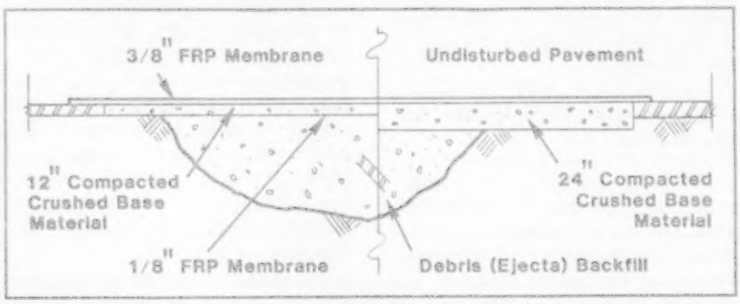


Figure 1. Double/single FRP membrane methods for repair.

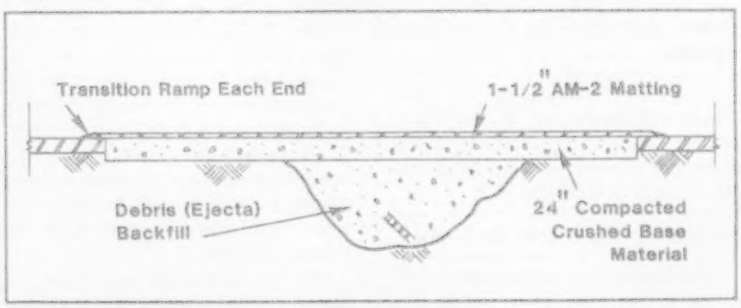


Figure 2. Crater repaired with AM-2 matting.

Three "Rs"

Continued from page 13

were airborne during the attack they must be able to land as soon as possible. There is no need to repair the runway for C-141 aircraft when only F-4 aircraft are using it.

Rapid runway repair provides a minimum runway 50 feet wide and 5000 feet long, plus a 25-foot wide meandering taxiway. It later expands the width to 75 feet. Remember, expediency is the first requirement. The centerline of the new runway may be a portion of the runway, taxiway, aircraft parking area or even a roadway. The runway should be repaired within four hours after the attack.

Begin Crater Repair

Start pushing the debris into the crater and off the runway when the crater fills.

The fill should be removed to a point 30 feet from the centerline. After the area is cleaned of large pieces of debris the bulldozer should move into the crater to break up the pavement chunks and start to compact the subbase. Stockpiling select fill material to be used in the top 24 inches of the crater should also begin now. When the subbase is filled to the proper height, remove the damaged pavement from the edge of the crater to a distance of ten to 15 feet.

Clean, Sweep and Paint the New Runway Markings

While the crater filling is in progress, sweep the runway clean of all pavement chips, shrapnel and other debris using graders and towed brooms. Following the initial cleaning and sweeping, new runway markings are painted.

Deliver and Assemble the Patching Material

Patching material may be AM-2 aluminum airfield matting or fiber-glass-reinforced plastic membrane. The patch is assembled or prepared while the crater filling is in progress.

Position the Patch over the Crater

Selection of the assembly site should allow for the patch to be pulled in a straight line over the crater.

Anchor the Patch

Install the ramps if AM-2 aluminum airfield matting is used. Drill the patch and pavement to receive the three-fourths-inch bolt and lead-sulfur compound.

Final Sweeping and Painting

Sweep the runway one more time to ensure all foreign objects are removed, then paint the centerline.

In short, this is rapid runway repair. It is a small but important phase of war damage repair. Without operational airfields, air supremacy cannot be maintained.

With the basic concept of rapid runway repair explained, consider the P36 component. The P36 component appears to be designed to work on nine craters at one time. This will require approximately 180 people, which is twice the number the Air Force uses. One hundred eighty people are a lot of people to commit to the runway repair and still try to get the base back into operation. The Air Force proved it can be done with 90 people.

There will be casualties; personnel will be required to get the vital services back into operation. The component needs to be evaluated by those who are knowledgeable in rapid runway repair. As mentioned before, the frustrating nomenclature problem probably led to the grossly over-planned component. Apparently the planners had little or no concept of rapid runway repair. The Air Force uses 90 people to repair three craters in four hours. The P36 component therefore can be reduced to a size adequate to repair four craters, rather than nine.

The converter dollies and highboy trailers are of little use and are not required; therefore, they should be deleted.

The TD-20 Model bulldozer with ripper is much too large for crater filling and will do more damage to the pavement than did the bombs. There is no requirement for ripping pavement. If a large bulldozer is retained in the component for war damage repairs, smaller bulldozers must be added for crater repair which happens to be the primary mission.

Drilling pavement to receive the three-fourths-inch anchor bolt is accomplished with a small electric or air-driven drill. The minimum depth to be drilled is three inches.

The wagon or drifter drill and 750 CFM compressor are not required, although the 125 CFM compressor and pavement breaker kit may be useful to remove the upheaved pavement.

Although there are no forklifts shown in the component, there should be 11 rough terrain forklifts for loading and unloading patch materials and assist the front end loader in pulling the patch into place.

The front end loaders in the component are full tracked front end loaders which should be replaced by wheeled front end loaders for more flexibility and speed. Utilizing the front end loader as a forklift using the quick coupling system is out of the question. The front end loader will be used to capacity filling the crater and stockpiling the select base material.

The small bulldozer is working in the crater compacting the debris. Nine industrial tractors are not required and should be deleted. Two rotary brooms should be added to sweep the runway. The brooms can be towed by the magnet sweepers.

Having considered the new technologies in rapid runway repair, employing eight steps will complete the repairs within the four-hour timeframe. The P36 component must be revamped; it should be reduced to work on just four craters.

The P36 component should be designed for rapid runway repair.

The Naval Mobile Construction Force unit best suited for this mission is a Construction Battalion Maintenance Unit, not an air detachment. The Construction Battalion Maintenance Unit should be on site maintaining the newly constructed facility as the Naval Mobile Construction Battalion is completing it. A public works department should be assigned the mission at permanent facilities.

Base personnel other than Seabees or public works personnel must be trained to assist with both rapid runway and war damage repairs. The Seabees or public works personnel should form the nucleus of the rapid runway repair team. Base personnel should be trained in assembling the patch, marking the runway and providing what other labor may be required. □

speaking from topside

departments

Trusting our leaders with more authority "gives us an edge"

Several issues ago, one of our former Chiefs of Civil Engineers, RADM Donald G. Iselin, commented in this column about the excellent performance and reputation of the Civil Engineers Corps and NAVFAC. I certainly can't argue with his remarks. In fact, from my experience in the Office of the Secretary of Defense, I would say they are precisely on the mark. I have seen and heard so many testimonials to Navy facility managers that, if I had not believed before that we have a good organization, I certainly would now.

But that's not the point I'd like to make. Instead, I want to ask, **Why** do we have such a good reputation? What causes that? It's important that we think about those questions. I'm convinced there is a reason, or reasons, behind our reputation; we didn't come by it simply by luck or by coincidence, certainly. And if there is a logical reason, a cause, an organizational trait behind that reputation, we'd better make sure we know what it is. We need to guard it zealously and nurture that trait in our junior officers.

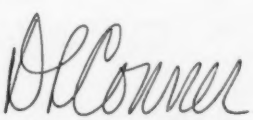
Let me explain why I believe the CEC/NAVFAC organization enjoys a competitive edge. First, though, I need to give my two-minute primer on how to run a good-sized organization.

It seems to me that any organized endeavor should be started with a well-defined set of objectives. If those objectives are fully understood, then everyone has a clear picture of what the organization is trying to do, what achievements it is shooting for, where it's trying to go and how much headway is needed to get there. Then the organization should be staffed with talented people and those people given some equally talented leadership. Next, the leaders and the people need guidance on what they are supposed to do. They have to understand the objectives and the responsibilities they have toward achieving them. Finally, the leaders and their people should be given authority, equal to their responsibilities, and in sufficient measure to get their jobs done.

That's all very simplified, I admit, but let's go back to that last point again. Clearly, it seems to me, if you hire talented people you must give them enough authority and freedom so that they will be able to fully exercise their talents. If you don't, you are certainly not challenging them to the full extent of their abilities.

I believe that the senior CEC/NAVFAC leadership, now and in the past, has shown a willingness to pass out enough authority to people to let them carry out their responsibilities and do their jobs well. And a willingness to accept the possibility that somebody might make a mistake. I've not seen that willingness in other organizations — at least not to the same extent. I think we've done a good job with all the points in my primer. But I believe our success with the last one makes the difference and gives us an edge.

We need to nurture in our junior officers the same willingness. We need to show how to develop the wisdom to let people have the authority and freedom they need to do their jobs. And how to develop the courage to let people make a mistake now and then. The several Chiefs of Civil Engineers, over the years, have been showing you those lessons. Pay attention. They're good lessons to learn.



D. L. Conner
Rear Admiral, CEC, USN
Director of Construction

news worth reviewing

departments

Kudos: Seabees Honored at Child-Abuse Center

Recently, during National Child Abuse Prevention Week, Naval Reserve Mobile Construction Battalion 16, Detachment 0216, designed, planned and constructed playground equipment for the Richstone Center for the Prevention of Child Abuse and Neglect in Hawthorne, California.

The Richstone Center is a small friendly house that sits in front of what used to be a chinchilla barn. High school students from the community converted the barn into counseling spaces and a therapeutic day nursery. Despite the tremendous community efforts, the ground looked bare and desolate.

In four months the Seabees planned, designed and constructed a playhouse with a fireman's pole, swinging bridge and climbing structures constructed out of tires.

With the playground equipment completed during National Child Abuse Prevention Week, the cities of Hawthorne and Lawndale proclaimed United Way People Helping People Day — U.S. Navy Seabees/ Richstone Center.

The RNMCB-16, Det 0216, Seabees received recognition from the city mayors of Hawthorne and Lawndale and the Los Angeles County Board of Supervisors, and United Way presented each Seabee with a gold award for outstanding community service.

The Seabee "thank you" event was covered by the local CBS, NBC and ABC television stations in the Los Angeles area on the evening news.

Friends and families of the community, the Richstone Center and the Navy, as well as celebrities such as Richard Hatch (Battlestar Galactica), Roxie Roker (Jeffersons), Sidney and Lindsay Greenbush (Little House On The Prairie) and Carl Irwin (General Hospital and Home of The Seabees), mingled as the children and the Seabees gathered to sing the Seabee song.

A few months ago, the children at the Richstone Center were asked what a Seabee was. One child answered, "A thing truckers use to talk to each other."

Now when the children at the Richstone Center are asked what Seabees are, they answer, "Navy men who built our playground."

Volunteer United Way worker Robert Fisher leads the children, RADM T. Maddock and the Seabees of NRMCB-16, Det. 0216, in singing the Seabee song while dedicating the swinging bridge built by the Seabees. The two in sailor hats (front center) are Sidney and Lindsay Greenbush who played Carrie Ingalls on television's "Little House on the Prairie."

Noah H. Long, Sr., as a Third Class Petty Officer in 1942

CDR Noah H. Long, Jr., CEC, USNR-R, Commanding Officer, RNMCB-24

Son Becomes C.O. of Dad's WWII Unit

The traditional change of command ceremony at Reserve Naval Mobile Construction Battalion 24 (RNMCB-24) had special meaning for CDR Noah H. Long, Jr., CEC, USNR-R, as he assumed command on Oct. 1, 1982. CDR Long's father, Mr. Noah H. Long, Sr., is a plankowner of NCB-24 and served with it during the Pacific campaign of World War II.

At the ceremony CDR Long said, "Twenty-Four had an illustrious history in WWII, which Dad helped build, and an equally impressive record as a reserve Battalion which I intend to continue." Mr. Long attended and participated in the ceremony.

Mr. Long was a millwork carpenter building PT boats at Huntsville, Alabama, when the war started. He enlisted in the Navy immediately after Pearl Harbor and was called to duty when NCB-24 was formed from men in North Alabama and West Tennessee. The Battalion trained at Gulfport and shipped out of Port Hueneme to make the first amphibious landing of the war by the Seabees in the Aleutian Islands.

Mr. Long was severely injured in Guadalcanal and evacuated to New Zealand for medical treatment.

Mr. Long is now retired from Federal service as a game management agent and lives in Williston, Florida.

CDR Long is a 17-year Navy veteran. Following graduation from Tulane University in 1965, he was commissioned an ensign in the Civil Engineer Corps.

His last duty has been as the first commanding officer of the newly organized Reserve Naval Construction Force Support Unit One headquartered in Greensboro, N.C.

Underwater Tool Run By Seawater

Culminating six years of research and development, the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif., has con-

ducted successfully the first-ever test of a complete seawater hydraulic diver tool system.

In a Laboratory outdoor seawater tank, Navy divers operated various prototype components of the total system. Of particular interest was the performance of the unique NCEL-developed motor that uses seawater instead of oil as the working fluid.

The potential for seawater hydraulic systems is not limited to diver tools. The technology is adaptable to such areas as submersibles, amphibious vehicles, submarines, and shipboard machinery. Based on data developed from this successful test of prototype components, NCEL will design and fabricate a system adaptable for fleet use.

Hazardous Materials Center Open

The Hazardous Materials Technical Center (HMTC) has been established by the Defense Logistics Agency (DLA) to provide technical information and guidance on the handling, storage, transportation, and disposal of hazardous materials. The center will be operated by the Dynamac Corporation of Rockville, Maryland. DLA is the program manager; the technical monitor is the U.S. Army Environmental Hygiene Agency.

The primary purpose of HMTC is to gather, analyze, synthesize, store, and disseminate information related to the management of hazardous materials and wastes. The Center will develop handbooks, prepare state-of-the-art reports, publish abstracts of the current literature on a quarterly basis and respond to technical inquiries.

For more information about HMTC, call 800-638-8958 or write to HMTC, P.O. Box 8168, Rockville, MD 20856-8168.

Sea Cadets Train at Gulfport

Sixty Sea Cadets set aside their summer activities for two weeks and trained among pesky ticks and bugs and a hot sun and scored a super effort. The young men and women cadets were aboard the Naval Construction Battalion Center in Gulfport, Miss., August 1 to 14. They came from Naval Sea Cadet Corps (NSCC) units in 12 states to train in Seabee skills.

During the two weeks, the cadets learned about cardio-pulmonary resuscitation (CPR), first aid, and how to wear nuclear protective clothing. They learned the art of handling line for rappelling and slide-for-your-life exercises and enjoyed the task of gliding from a highline out of a 50-foot building.

According to Sea Cadet Commander Shirrell Richey, the retention rate for cadets joining active service is pretty good. He also stated that the ones that "drop out" usually do it here. And it's better to do it here than in the regular Navy.

Cadet Peter Mazur sailed on a highline out of a 50-foot-high building. Rappelling was his favorite excercise in the Disaster Recovery training.

World-Famous Sculptor Visits Magazine Offices

Felix de Weldon, world-famous sculptor, visited the offices of the Navy Civil Engineer Magazine and the Naval School, Civil Engineer Corps Officers, at Port Hueneme on Sept. 30. After picking up some back copies of the magazine, he was escorted by the editor to the Admiral Ben Moreell Library; to the office of CDR Alec Pringle, Executive Officer of the Naval School; and to the Seabee Museum where he was hosted by Museum Director Hark Ketels on a tour of the Museum's artifacts and displays. Many of the displays were created by de Weldon and this was the first time he had seen them in more than a dozen years.

Presidents, kings, admirals and generals are all commonplace to de Weldon. His career began in the 1930s when he sculpted the likeness of three English kings — King George V, King Edward VIII, and King George VI. Later he would sculpt the busts and statues of Presidents Eisenhower, Truman and Kennedy, and more than 1,200 monuments, some of them for the Navy. He is perhaps most famous for his monument of the Memorial Flag Raising on Iwo Jima.

Among de Weldon's works at the Seabee Museum are a miniature of the Flag Raising on Iwo Jima; the Seabee Bucket Scene; a bas relief

Felix de Weldon, world-famous sculptor (right), explains pictures of his work to Barbara Horn, Librarian — Moreell Library (center), and to CECOS Public Affairs Officer, Les Helsdon.

which includes the likenesses of Admiral and Mrs. Ben Moreell — founder of the Seabees, de Weldon, and Audrey Hanes — former director of the Seabee Museum. The bas relief was created to commemorate the opening of the Moreell Wing of the Museum in 1967.

Also on display are busts of Admirals Ben Moreell, Nimitz, Byrd, Carney, and Spruance; and a copy of the famous Seabee bas relief memorial monument and statue of a Seabee that is on display in Washington, D.C.

The original Seabee Bucket Scene has an interesting story behind it. The sculptured scene depicts four Seabees at work pouring concrete. Felix de Weldon was commissioned to sculpt the scene from a photograph chosen from more than 1,000 photos. The one he chose was taken at Cubi Point, Philippines, in 1954, and showed four builders working on a reservoir. The purpose of the sculpture was to show accomplishment through team work by Navy personnel.

Sculptor de Weldon was visibly surprised to learn that Hark Ketels, Museum Director, is one of the four men in the Seabee Bucket Scene. Ketels then produced a copy of the original photo used for the scene for de Weldon's autograph. □

Contracts administration with word processing

By LT GERALD T. FRENTZ,
CEC, USN
E.I.T., Pa.

• Houston, Texas

A significant aid to performing detailed contract management and supervision has been achieved, thanks to the word processing equipment in use by the Naval Facilities Engineering Command (NAFVAC) family. To a small public works office monitoring a $500 informal, lump-sum contract, or to an Officer-in-Charge-of-Construction (OICC) managing a multi-million dollar Cost-Plus-Award-Fee (CPAF) contract, the problems of personnel management, scheduling of work, knowing cost to complete and evaluating the contractor's performance are equally important.

Usually this kind of decision-making information is buried within the small details of the contractor's accounting and personnel systems. With the aid of the NAVFAC managed Wang word processing (WP) equipment, this information can be readily available for simple graphic analysis and decision processing.

Word processing has previously been limited for the most part by its operators to typing picture-perfect letters, memoranda, speeches, etc., which it does extremely well. Through the use of "glossaries," the now almost standard "Math Support Package" and "Sort" options, however, the Wang WP systems have the capability to be the only really effective labor-saving devices for managers.

Taking word processing above the letter writing stage, authors can program the equipment through glossaries to read, compute, display and graph any data that may be useful in solving daily contract administration problems, as well as the periodic requirements for justifications, budgets, or evaluations present with any contract.

In an effort to solve these problems, and at the same time assist the contractor in preparing required reporting information to be used in this daily and periodic decision making process, a series of glossaries and standard document formats were developed to provide the basis for an advanced use of word processing.

The examples presented here were based on the work surrounding the multi-million-dollar CPAF contract for facilities expansion on Diego Garcia; the concepts and many of the documents and glossaries are entirely applicable to any level of government contract.

For examples, the basic areas of personnel salary overhead, equipment and direct labor usage, construction work in place measurement will be discussed, and conclude with some general graphic applications.

PERSONNEL

A significant part of a contract's cost to complete is the overhead. This normally includes the salaries of support personnel and indirect labor. A similar salary cost is that for the Resident-Officer-In-Charge-Of-Construction (ROICC) supervision and inspection personnel that will be taken out of supervision, inspection and overhead funds.

In an operation involving some mobilization period prior to the start of permanent line item (PLI) construction, the types and sources of support personnel are likely to be varied. Their periods of employment can also be expected to vary greatly depending on the mobilization needs of the contract.

A consolidated listing was developed showing each employee's name, position title and code number, job description or billet sequence number, projected or actual hire date, projected or actual release or rotation date, salary category or grade/step salary, allowable salary range, previous company or agency source, Department of Labor classification and EEO indicators, and date of next periodic salary review, step increase or performance evaluation.

The listing can be sorted by any of the categories mentioned above to show such information as: numbers of personnel arriving or departing in a given month (to verify camp or office space requirements); salary comparisons based on EEO classification, grade and step level, or previous employer (to document Affirmative Action Plan compliance); numbers of temporary hire individuals or "specialist expertise" needed to cure a short-term bottleneck; or positions where a high turnover is occuring.

Two particularly useful glossary programs that operate on this list provide, (1) a daily on-board count allowing rapid visualization of transportation, office space and berthing needs, and (2) a monthly incremental or cumulative salary forecast which can be adjusted for acceleration, anticipated annual pay raises, or other burdens.

DIRECT LABOR/EQUIPMENT

While the indirect labor is certainly important, it is the direct labor and equipment usage which will get the project completed. Rather than use the previous format to describe each individual worker (although for small crews this could be done), all personnel of the same trade designation can be grouped together and applied against the proposed schedule. This would produce manpower requirements for carpenter helpers, masonry workers, pipefitters, paving crews, etc.

This type of analysis operates equally well on specific types of equipment. Requirements for a particular item can be spread over a bar-charted project schedule and processed by glossaries to develop a loading diagram. Although some of NAVFAC's automated data processing (ADP) assets will generate similar displays, the advantage to the OICC/ROICC/PW office rests with the multi-function capability and use of WP equipment.

Where ADP facilities tend to be somewhat inflexible and limited to strictly processing numbers, WP can be used by the manager to do the decision processing, and by the secretary to promulgate that decision with the appropriate back-up data and displays in an appropriate size and format.

CONSTRUCTION WORK IN PLACE MEASUREMENT

During the main construction phase of any contract, there is an ever present requirement to know how far the contractor has progressed or how much of the work is left to be done. This can become an extremely detailed and time-consuming process for both the

contractor and the inspector. To simplify this effort and still generate an accurate picture of the work-in-place (WIP) done to date, the OICC and the contractor jointly developed a standard form for glossary processing and reporting that shows the various ordinate values and percentages needed to arrive at that portion of the contract value that is complete.

Figure 1 illustrates the use of this form to track one of the PLI projects and report the progress on the various construction elements (corresponding to the precedence network activities) and show their effect on the line item percent complete as well as the contract WIP percent represented by that work.

Glossary processing of the reports for many line items will produce a set of weighted WIP percents that the contractor is expecting to attain, as well as show the actual progress.

GRAPHIC ANALYSIS

The other major area of concern is contractor performance against some baseline. For this purpose it is necessary to record estimates for future use into discrete "data sets." When new, current, or updated information is available, a comparison data set is recorded. A simple, standardized, titled array of 12 columns of data and one column of reference dates was developed. The columns and rows of numbers can be incremental or turned into cumulative values by glossary. Subtotals or grand totals of columns and rows can of course be generated, and glossaries made to update such totals when some of the data changes. To standardize the sets for graphic analysis, a convention of 52 weeks or 48 months was established.

Simple curve graphs can be generated from one or more columns on a page, or from columns on different pages in a document. Glossaries that operate here generate a basic blank 48 month (or 52 week) graph form. After the operator indicates what the largest number is to be graphed, an appropriate scale factor is applied and the values on the left side of the graph are automatically recalculated to fit the data. The glossary returns to the data set for operator selection of the column to be displayed. It then places one point for each of twelve numbers per pass on the graph. The additional columns are selected and displayed as desired by the operator. The glossary specially marks coincident points if the same value was previously graphed.

Additional glossaries available operate on the simple graphs to add columns of shading. This is useful for depicting variations of the current data from the baseline figures. An example of this is shown in Figure 2. The columnar graph may be preferred even when no comparison is necessary as it tends to emphasize the value of the numbers plotted. Thresholds, or limitations, can then be applied manually by the author to aid the decision making effort.

SUMMARY

The value of the word processing equipment currently in use for contract administration as a "decision processing" tool has been established. The production of standardized reference documents and glossaries has established an effective carry-over of procedures from one contract to another. The graphic displays covered at the end of the article can be set up to work on any set of data within any given dates. □

(Want to request these documents? See page 32 for details.)

PERMANENT PLI NO	LINE ITEM WORK IN PLACE REPORT FORM TITLE	ON ISLAND REPORT	LAST RPT YY.MM.DD	THIS RPT YY.MM.DD	ESTD. COST SCHEDULE "A"	LINE ITEM PERCENT LAST + THIS = TOTAL x			L/I WGT	CONTRACT = WIP %
1	AIR CARGO TERMINAL		82.07.24	82.07.31	1,550,000	50.83	8.91	59.74	0.0054	0.32465

CPM ACTYS	CONSTRUCTION ELEMENT DESCRIPTION	START 82.0410	DUR WKS	END 83.0215	UNIT OF MEASURE	TOTAL UNITS	UNITS IN PL	DEC % IN PL	ELM WGT	L/I DECX IP
100.104	UNDERGROUND ELECTRICAL	82.0410	2	82.0421	EACH	1	1	1.000	4	0.04000
100.105	UNDERGROUND PLUMBING	82.0411	1	82.0422	EACH	1	1	1.000	4	0.04000
100.110	UNDERGROUND FOAM TANK	82.0810	1	82.0818	EACH	1		0.000	2	0.00000
103.200	FREPS FOUNDATION & SLAB ON GRADE	82.0412	6	82.0526	BAY	12	12	1.000	10	0.10000
104.400	ABOVEGROUND ELECTRICAL ROUGH-IN	82.0909	5	82.1014	EACH	1	1	1.000	2	0.02000
200.300	ERECT PEB FRAME	82.0520	3	82.0606	BAY	12	12	1.000	15	0.15000
200.402	ERECT MECHANICAL PLATFORM	82.0810	1	82.0814	EACH	1		0.000	2	0.00000
106.107	CONCRETE AND ASPHALT PAVING	82.0811	6	82.0924	EACH	1		0.000	1	0.00000
107.108	CONSTRUCT FENCE	82.0925	4	82.1020	EACH	1		0.000	1	0.00000
300.402	METAL ROOF	82.0607	8	82.0807	BAY	12	11	0.916	5	0.04583
300.409	PLUMBING	82.0621	10	82.0901	EACH	1		0.000	2	0.00000
400.408	ABOVEGROUND ELECTRICAL-F&F	82.1015	8	82.1207	EACH	1		0.000	4	0.00000
402.405	CMU WALLS	82.0614	8	82.0810	BAY	12	12	1.000	16	0.16000
402.502	WALK-IN COOLERS	82.0824	2	82.0910	EACH	2		0.000	1	0.00000
405.406	BUILDING FINISHES	82.0811	14	82.1115	BAY	12		0.000	12	0.00000
405.407	SIDING	82.0722	3	82.0810	BAY	12	10	0.833	5	0.04166
405.410	AIR CONDITIONING	82.1130	11	83.0215	EACH	1		0.000	9	0.00000
405.500	F/W TANK	82.1122	1	82.1203	EACH	1		0.000	1	0.00000
405.501	FIRE PROTECTION	82.1204	2	82.1216	EACH	1		0.000	4	0.00000

Figure 1.

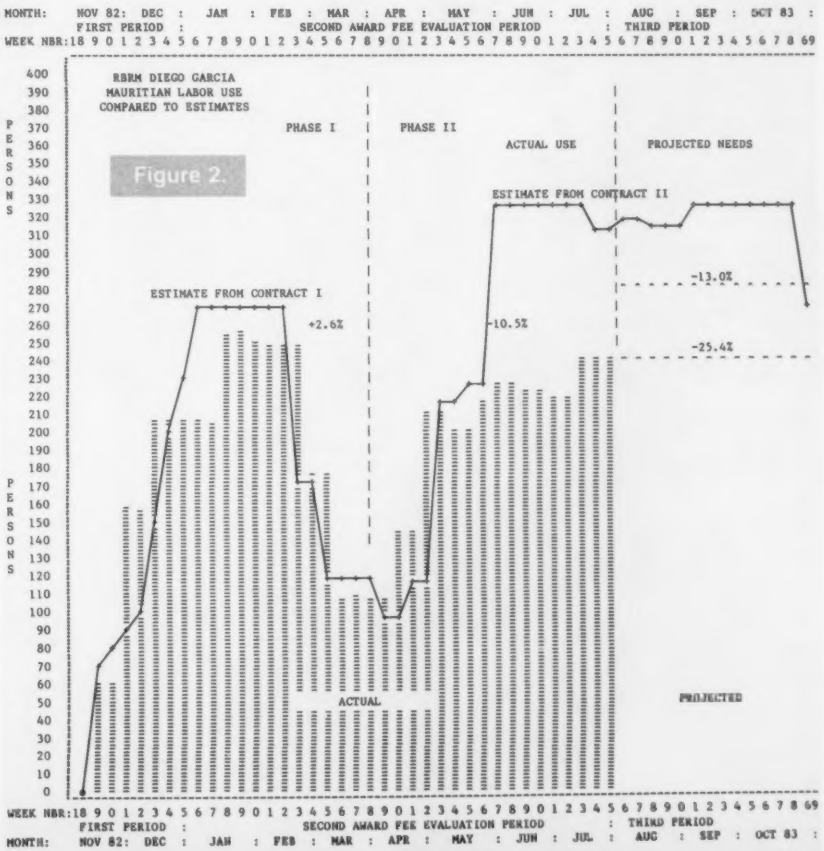

MONTH: NOV 82: DEC : JAN : FEB : MAR : APR : MAY : JUN : JUL : AUG : SEP : OCT 83 :
FIRST PERIOD : SECOND AWARD FEE EVALUATION PERIOD : THIRD PERIOD
WEEK NBR: 18 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 69
RBRM DIEGO GARCIA
MAURITIAN LABOR USE
COMPARED TO ESTIMATES
PHASE I
PHASE II
ACTUAL USE
PROJECTED NEEDS
ESTIMATE FROM CONTRACT II
ESTIMATE FROM CONTRACT I
+2.6%
-10.5%
-13.0%
-25.4%
ACTUAL
PROJECTED
PERSONS
400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
WEEK NBR: 18 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 69
FIRST PERIOD : SECOND AWARD FEE EVALUATION PERIOD : THIRD PERIOD
MONTH: NOV 82: DEC : JAN : FEB : MAR : APR : MAY : JUN : JUL : AUG : SEP : OCT 83 :

Figure 2.

CDR Geibel and his son Eric ride a camel at the foot of the Pyramid of Cheops outside Cairo, Egypt, while on vacation.

CEC bonds friendship in Saudi Arabia

The author and his family traveled to this interesting and exotic country on assignment and describe their experiences there. (This is the second in a series of unusual assignments of CEC officers.)

By CDR BRUCE B. GEIBEL, CEC, USN

CONTRIBUTIONS BY:

CDR Joseph P. Bivins, CEC, USN
LCDR Robert R. Setzekorn, CEC, USN
LCDR Blair Ackerbauer, CEC, USN

• Saudi Arabia

A handful of Civil Engineer Corps (CEC) officers are in the Kingdom of Saudi Arabia helping develop one of the world's newest and fastest growing navies. These officers have drawn one of the most interesting and challenging assignments of them all — in one of the hot spots that's in the news daily, both as the premier exporter of oil and for its much publicized requests for controversial weapons and military surveillance systems from the United States.

THE BEGINNING

As early as 1945, King Abdul Aziz Ibn Saud and President Franklin D. Roosevelt established a "Bond

The four family snapshots above show the Geibel family at play. (1st photo from left) The geibel family, (l to r) Eric, Lisa, Sandy and Bruce stand at the foot of Mt. Kilimanjaro, Kenya; (2) The Geibel family gather at the Step Pyramid, Egypt; (3) Eric and Lisa dressed in typical "Arabic" clothing; and (4) Eric and Lisa stand beside the entrance sign to Tsavo West National Park in Kenya.

of Friendship" between the Saudi Arabian Government and the United States Government.

In 1969, the Royal Saudi Naval Forces (RSNF) made a request to the United States to be the sole agency for managing the development of the RSNF.

In 1972, a Memorandum of Understanding was signed by the two governments setting forth the terms of the Saudi Naval Expansion Program (SNEP) and identifying the services, ships, craft, and facilities to be provided by the U.S. Government.

The U.S. Navy was designated as the agency responsible for the program management and the U.S. Army Corps of Engineers (CE) as the construction agency for major SNEP shore facilities.

In August 1978, the U.S. Navy established a Project Management Office (known as PM5) to strengthen SNEP Management. PM5 is responsible for project management, integration, and coordination within the Navy, and also for maintaining liaison with the U.S. Army Corps of Engineers on construction matters and with the RSNF on a wide range of matters. The present cost estimate for this program is almost 13 billion dollars.

Civil Engineer Corps officers are assigned to critical "facilities" billets throughout the program: at PM5 in Washington, D.C.; in Saudi Arabia — King Abdulaziz Naval Base at Jubail on the Arabian Gulf; King Faisal Naval Base at Jeddah on the Red Sea; and RSNF Headquarters in Riyadh, the capital of Saudi Arabia.

To obtain the additional manpower necessary to perform all the operations and maintenance functions at its naval facilities, the RSNF authorized the U.S. Navy to enter into a contractual arrangement with a U.S. firm, the HBH Company — a conglomerate of Hughes Aircraft Company, The Bendix Corporation, and Holmes and Narver, Incorporated — to augment the RSNF forces.

In terms of monetary scope, the Civil Engineer Corps officers are involved in advising the RSNF in a multi-billion dollar program consisting of over 7 billion dollars in facilities construction, as well as monitoring the O&M contractor in the performance of operations and maintenance functions.

For thousands of years, the desert life of the Saudi required conservation of energy in order to cope with the shifting desert sands which may reach 120-160°F in the heat of the afternoon. In spite of the fact that most facilities are fully air conditioned, even today, the Saudi starts work at 7:30 a.m. and normally stops work at about 2:00 p.m. to retire to his home for a late lunch and siesta time, before returning to work at 5:00 p.m. (in the commercial districts) when it is cooler. Tradition still drives the work system throughout the Kingdom, and the entire Middle East for that matter.

For Americans working in Saudi Arabia, this pace can sometimes be extremely frustrating. With patience, however, the rewards more than compensate for the frustration factor, as day-to-day the sound, professional advice, diplomacy, tact, and friendships developed through the advisory relationship bear fruit in the growth of the Royal Saudi Naval forces.

AN ENTIRE COUNTRY UNDER CONSTRUCTION

If the value of the SNEP program sounds high, one must remember that it is only a small part of the total construction effort ongoing in the Kingdom of Saudi Arabia. Construction actually surrounds you, as the Kingdom is busy returning its vast oil profits to the people of Saudi Arabia in the form of roads, parks, airports, housing projects, and other public facilities of every description.

'Wife' introduced as 'brother'

If the value of the SNEP program sounds high, one must remember that it is only a small part of the total construction effort on going in the Kingdom of Saudi Arabia. Construction actually surrounds you, as the Kingdom is busy returning its vast oil profits to the people of Saudi Arabia in the form of roads, parks, airports, housing projects, and other public facilities of every description.

For example, some 12 miles north of the city of Jeddah stands the recently completed and operational King Abdulaziz International Airport where over 11,000 men labored around the clock for nearly five years.

When all phases are totally complete it will cost in excess of $4 billion, will cover over 40 square miles, and by 1985 will be capable of handling over 8 million passengers a year.

This airport is twice the size of Manhattan Island, or one and a half times the size of the New York airports (Kennedy and LaGuardia), Newark, O'Hare (Chicago), and Los Angeles International put together.

PEOPLE AND CUSTOMS

Major adjustments must be made in becoming accustomed to the local people and customs — for example, clothing. Although some in the cities wear Western garb, most Saudi men prefer the full-length, skirt-like garment (thobe), sandles, a skull cap and head covering (ghutra) wrapped with a rope-like crown (igall). When outside, women wear a long dress (abayah), usually black in color, which covers them from head to foot, including a veil worn over the face.

The Arabs are good-humored, well mannered, kind and informal people, and are unlikely to take offense at unintentional social blunders by ignorant foreigners. Large families are the rule rather than the exception, and almost every Arab that passes you will pat your small child on the head or tweak his or her cheek as he passes. Close friendship is not gained lightly, however, but the patience and hard work it takes to develop it are well worth the effort.

Religion is the way of life in Saudi Arabia. Moslems pray five times daily — wherever they happen to be — when called to prayer from the "call" from the nearest mosque. It's a common sight to see cars parked along the roadway, with the driver and passengers kneeling outside the car, facing Mecca and praying.

Normally, when visiting an Arab home or office, the Arab host serves you Arabic coffee, tea ("shai"), or a soft drink as soon as you arrive. A bearer may serve Arabic coffee flavored with cardamon in tiny cups, and will wait patiently to serve you again — two or three cups are usually considered sufficient. The sign to indicate "no more coffee" is to shake the cup with a wrist motion when returning it to the pourer.

Some words/phrases in Arabic do not translate literally to English, and the advisors and their families had some adjustments to make. For example, there is no literal translation for the "Public Works Department" into Arabic. This Department is now referred to as the Facilities Operation and Maintenance Department (or, in the true Navy fashion abbreviated to FACOM Department).

The Arabic phrase "He is as big as his date trees but only as wise as his kids" translates into English as "He is all brawn and no brain."

One day shortly after Commander Geibel arrived in Jeddah, he sought to use a newly learned Arabic phrase to gain entry for his family to the base. He introduced what he thought was "my wife" in Arabic to the gate guard, but it turned out that he was introducing "my brother."

After some confusion, some chuckling, a response in Arabic from the guard trying to straighten out the matter, the guard finally let them in the gate, but he must have figured they were the "odd couple" for sure.

The Geibel family, (1 to r) Sandy, Bruce, Lisa and Eric stand at the base of the Temple of Olympian Zeus with the Acropolis in the background in Athens, Greece. In the photo on the right, CDR Geibel "finds a new body" with the statue of Emperor Hadrian in Athens, Greece.

SAUDI HISTORY

The kingdom of Saudi Arabia, occupying about 80 percent of the Arabian Peninsula, is about 830,000 square miles in area (about one-fourth the size of the U.S.) and is inhabited by some ten million inhabitants. The majority are either small farmers or villagers, with nomadic tribesmen — called Bedouins — making up about one-seventh of the population.

Saudi Arabia is the world's leading oil exporter and is in the process of changing a desert society into an industrial country. The legal system is based on Islamic law as followed by the conservative Wahahibi revival movement. The religion is Sunni Muslim. The language is Arabic, although with so much Western influence during the last couple of decades, many Saudis speak several languages, including English. Saudi Arabia is the keeper of the most sacred sites of Islam — Mecca and Medina — where, Muslims

believe, the Prophet Mohammad received the words of the Koran in the seventh century A.D.

Oil revenues have grown to over 100 billion dollars a year and have financed advances in health care, education, housing, and public facilities, encouraging urbanization. Foreign technicians and laborers work in every facet of Saudi business enterprises and therefore form a large segment of the population. The economy thrives on petroleum and petroleum products, and cement and fertilizer production. Major domestic consumption consists of grain, livestock and dates.

LIFE FOR AMERICANS

The Civil Engineer Corps officers, and their families, for those on an accompanied tour, live in American-style communities. Those in Jeddah and Jubail live on the huge naval bases (in American style communities) along with the contractor's personnel who maintain the bases and the RSNF.

Those in Riyadh live in American-style communities and apartment complexes. Housing is 2- to 4-bedroom housing, complete with dishwashers, furnishings, and TVs.

The communities contain tennis, basketball, and handball courts, swimming pools, convenience stores (Commissary), variety stores (PX), mess halls, and snack bars. Transportation is provided by the host government as is all gasoline and maintenance.

The normal work week is five days, from Saturday through Wednesday, with weekends on Thursday and Friday, to conform to the Middle East week, although this tends to fluctuate upward voluntarily becase the O&M Contractor works a six-day week from Saturday through Thursday and because there are so many rewarding professional projects to accomplish. Even the American-style and operated dependent schools operate on the same five-day schedule.

Recreation facilities at all locations are excellent and focus on aquatic sports such as snorkeling, skin diving, swimming, fishing and sailing at Jeddah and Jubail. Each base has a variety of other recreational activities, including movies and video-tapes, swimming pools, softball, pool tables, and soccer.

The Arabian souks (market in Arabic) are fascinating with their bustle and color. There are book stores, pharmacies, design and furniture shops, stereo shops, camera shops, stationery stores and many other specialty shops.

The face of the souks changes daily as new shops are born, new streets and pathways are carved, and old places are renovated or relocated. Some shops are no larger than a small closet; some are as large as a stateside department store.

Vegetable souks carry numerous types of fruit and vegetables from all over the world, some you will recognize from the States, and others from Africa, Lebanon or other areas.

Supermarkets stock groceries from many different countries: butter from Denmark and Ireland; milk from Germany and France; and canned goods from England, United States, Brazil and Poland.

The Arab souks are truly amazing. Most Western

Women can't drive autos here

women enjoy browsing through the antique souks or prowling the gold souks for the latest gold bracelet, necklace, charm or brooch. Then, with a "basket boy" to carry their purchases, they are off to find the rest of the exotic and everyday items on their shopping list.

The opportunity to travel is one of the distinct advantages of being in an overseas location, and particularly in Saudi Arabia which is so centrally located with respect to the major cities of Europe, Africa and Asia.

Members of the CEC community and their dependents have logged thousands of miles of exciting travel throughout the area including trips to: Kenya on safari; Egypt to view the Sphinx and Pyramids; Jordan to view the ancient Nebatean ruins of Petra and the mountain splendors of Wadi Rum, where parts of "Lawrence of Arabia" were filmed.

They have walked the old tracks of the Hejaz Railroad (also of Lawrence fame) near Tabuk, Saudi Arabia; sampled Greek Salads and "Ozo" in Athens while viewing the Acropolis and enjoying Greek dancing in a local Taverna; and many have visited most of the major cities in Europe — Rome, Madrid, Paris, Frankfurt, London, Lisbon, Amsterdam and Salzburg to mention only a few.

SOME HANDICAPS — MANY CHALLENGES

As is true with any tour, there are some handicaps to living in Saudi Arabia. Women can't drive and should not travel alone forcing "hubby" to accompany wives on most shopping trips, although free bus and chauffeur service is available on most occasions for larger groups. Dress is very conservative outside the home and at the swimming pools (normally long sleeves and colorful dresses to the ankles and one piece bathing suits for the women). Traffic conditions are horrific, crowded, and extremely hazardous on most occasions. Even two-lane roads end up in five-lane freeways with vehicles coming from all directions, and travel is measured in time in lieu of distance.

However, after considering all the factors, the advantages still outweigh the disadvantages. Theft or outright dishonesty in the Kingdom is virtually unheard of since Islam is both specific in its prohibitions and swift and severe in its punishment.

Bargaining for goods and vegetables in the souks can take several hours, but once a price is reached the purchaser can be assured he has gotten precisely what he paid for. Many merchants will even allow you to take an item home (e.g., an oriental carpet) to see if you like it, and you can either return the merchandise or pay for it later.

For the CEC officers and their families, this tour is one of the most exciting the Corps has to offer. The opportunity to share American and Arabian culture, customs, language, and friendships makes it one of the best. □

Extensive fire testing by the Underwriters Laboratories (UL) resulted in UL roof deck construction classifications. These classifications permit the use of PUF roof systems at Naval facilities.

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There are many relatively new roofing products on the market today. They are the result of much research and today's increasing technology. Among them is the sprayed-in-place polyurethane foam roofing system (PUF). Although the system has been in use in the private sector for about 15 years and used both experimentally and in practice by the Navy for about 12 years, it is misunderstood and not being used to its full potential.

Actually, polyurethane foam has been around longer than 15 years since it had its beginnings in Germany during World War II. It was introduced to this country shortly after the war and used for cushioning and refrigeration insulation.

Although many attempts were made to use it as a roofing material, it has only been during the past 15 years that the material has become of any real importance in the industry.

The material consists of the following. The urethane foams are chemically complex polymeric materials formed by the reaction of liquid isocyanates with liquid polyol resins. Polyurethane components may also include cell-stabilizers, fluoro-carbon blowing agents (R-11), combustion-retarding agents, catalysts and fillers.

The heat of the above reaction causes the R-11 to vaporize and form cells as the reacting material changes from a liquid to a cellular mass. Depending on the chemicals used at the beginning, either a flexible or a rigid foam can be produced.

In the case of the sprayed-in-place polyurethane roofing systems, a rigid foam is required for the same reasons that conventional roofing systems require rigid board stock insulation.

Among the reasons for misunderstanding PUF systems is when the systems were first introduced, they were looked upon as a panacea to solve all roofing problems, to be used anywhere and everywhere. If a leak occurred it could be foamed over and the problem would go away. Unfortunately, other problems quickly arose and gave the product a bad name. Most problem areas have been largely a result of use in inappropriate locations; use of improper coatings; improper application; abuse after application; lack of proper maintenance; and ignoring fire safety criteria. An explanation may clear up some of the misunderstanding.

First, consider where to use PUF, or better yet, where not to use it. PUF *should never* be sprayed on a wet or even damp surface. This cannot be emphasized too strongly.

Many of the early failures of PUF roofing systems, including some Navy roofs, were caused by this very thing. Failure results from the moisture reacting with the isocyanate component and giving off carbon dioxide gas. This leaves a high porosity, lower quality foam over the damp surface. The adhesive and cohesive strength of the foam in this area is generally affected resulting in blister development, sometimes at a later time.

Inspectors should be aware that

PUF roof systems have shown excellent performance on virtually every type of roof deck. On concrete decks . . .

on wooden decks . . .

and on metal decks.

When first introduced, PUF roofing systems were advertised as a panacea for all roofing problems. The application of PUF over wet, built-up roofs often resulted in disaster as shown.

foaming cannot be permitted when there is rainfall, visible moisture, fog or snow. Also, foaming operations *must* be suspended when the dew point is less than 5°F above the deck surface temperature.

Spraying of PUF over a moist surface generally causes failure; unfortunately, this has caused some resistance to the use of the systems on Navy roofs today.

Other areas where PUF roofing systems cannot be used are on surfaces that are too cold — i.e., below 50°F; too hot — i.e., 120°F; dusty; greasy; or otherwise contaminated.

In the early days of the industry, no one was really sure which coatings would perform satisfactorily. This led to the use of many improper coatings. Most of the improperly coated foam systems ended in failure; consequently, PUF roof systems also got a bad name.

Acrylic house paints that are not compatible with urethane foam were used. Aluminum pigmented asphalt paints, conventional house paints and hot asphalt and gravel were tried and failed. In many cases, good elastomeric coating systems were applied at less than minimum dry film thickness causing systems to fail.

It is strongly emphasized that the absolute minimum dry film thickness for any coating system is 20 mils. Some generic types of coatings require even greater minimum dry film thicknesses. Coating manufacturers should be contacted for their recommendations.

Based on these unfortunate experiences, and particularly on extensive testing, both in the laboratory and in the field, the point has been reached where proper coating systems can be specified. When properly applied at the proper thickness, proper coating will lead to a long and useful life for the PUF roofing systems.

It has been found, for instance, that the coating must be elastomeric, i.e., stretch and recover; it must protect the PUF from solar (UV) degradation; it must be moisture resistant; it must adhere sufficiently to the foam to resist delaminating due to moisture, wind uplift, and mechanical forces; it must be tough enough to withstand physical abuse from such things as foot traffic and weather conditions (such as hail); and finally, the coatings must be fire resistant in order to meet code requirements when tested in combination with the foam and deck being used.

Among the elastomeric coatings which have been used successfully are silicones, urethanes, acrylics, butyls, Hypalons, and Neoprenes. The single component urethanes, butyls and Neoprenes do not weather well by themselves and must be treated with a more weather resistant coating such as Hypalon.

The polyurethanes can be either single component (moisture cured) or two component (catalyzed). They all have unique properties and the proper coating systems must be chosen for the particular job at hand.

Another of the early-day serious problems arose because of improper application of foam and/or coatings. The spray foam mechanic or "the man on the gun" today must be a highly trained technician.

When the industry was in its infancy, however, spraying was generally done by applicators who were learning by trial and error, mostly at the customer's expense. The foaming equipment and application techniques were still being developed and many disasters occurred as a result.

Today, the foam mechanics are skilled in the trade and understand the uses and limitations of the equipment. Among the problems that can arise as a result of improper foam application are irregular surface texture, poor quality foam, and pinholes or blowholes. These can lead to premature failure.

If the mechanic is competent, foam passes will be of a uniform thickness (1/2″ to 3/4″ on each pass), will have a smooth or "orange peel" surface texture, and will be free of unacceptable surface textures such as ripples, popcorn or treebark.

If the inspector feels that the mechanic is not sufficiently skilled, the application should be stopped immediately. It is much easier to prevent poor application than to remove poorly applied PUF. It is extremely difficult and costly to correct these conditions after the material is in place.

Fire safety should be considered. Fifteen or 20 years ago, little attention was paid to fire safety codes, or Underwriter's Laboratories or Factory Mutual Classifications. The industry was only concerned with selling the product in large quantities and using it in as many ways as possible.

It is now realized that this approach

The application of sprayed PUF roofing to the Butlerib roof deck of the Naval Reserve Center, Clifton, NJ, resulted in an annual heating energy savings of 54%.

was wrong and both the industry and the Navy are trying to correct the situation.

The Department of Defense (DOD) Construction Criteria Manual DOD 4270.1M and NAVFAC DM-8 (Fire Protection Engineering) require that all roof systems on combustible roof decks, including metal decks, have an Underwriter's Laboratories (UL) Roof Deck Construction Classification or a Factory Mutual (FM) Class I classification for a fire within a building.

In addition, PUF roofing systems should be classified under UL 790 for exterior fire exposure. For many years it was believed that PUF roofing systems sprayed directly on metal decks would not meet the UL Roof Deck Construction Classification. However, the Navy Civil Engineering Laboratory (NCEL), with NAVFAC support and financing, spearheaded the testing of some of the PUF/metal deck systems at UL. Results of this fire research proved that properly formulated PUF systems applied directly to metal roof decks performed as well or better than conventional built-up roof systems when subjected to fires within a building (Subject 1256, Roof Deck Construction Test).

A large number of these systems have now been tested in accordance with UL 790 (top of the roof fires). A substantial number have also been tested in accordance with Subject 1256 (fires within a building) over three different metal roof decks.

Before discussing maintenance, consider materials in today's world. There are many good materials available, but poor quality materials are available also. Similarly, while there are many good applicators, there are also many applicators who have had little or no experience with the application of PUF roofs.

It is too easy for those who don't know enough about the technology to get their hands on the equipment and the materials. Applicators need much training. When applicators who do not have the know-how to be foaming do it wrong and a disaster occurs, it's the foam roof system that gets the bad name, not the applicator.

Assuming all problems associated with selecting and placing a good PUF roofing system have been overcome, proper maintenance of the system in place must be considered. Part of the maintenance is preventative.

The surface must be protected from abuse by foot traffic, tools and equipment. Even ladies' high heels could puncture the surface. No one should be permitted on the roof who does not have business there. Where mechanical equipment must be serviced, proper walkways should be constructed during the original application of the roofing system in order to protect the surface from abuse.

A very important part of a good maintenance program is proper inspection. As with other roof systems, PUF roofs should be inspected twice a year, particularly for breaks in the coating surface.

One of the advantages of a PUF roofing system is that most of the damage that will happen during the first 10-12 years of its life can be repaired by the inspector at the time of the inspection. Depending on the size of the roof, the maintenance time per roof per year may be nil, but the inspections must be made.

It must be anticipated that some time after application, probably between 8-16 years, the elastomeric coating will erode to the point where recoating is necessary. Some of the coatings now under development may last a full 20 years without recoating. Even then, recoating is not difficult and certainly not expensive compared with reroofing. Applied costs for the original PUF roof system, together with recoating costs, often are comparable to the applied cost of a conventional roof system.

Sprayed urethane for roofing systems has other advantages. For instance it is a monolithic, seamless material; it is a relatively strong and lightweight, high quality insulation; it has superior adhesion to all known roof deck materials; because it is applied as a liquid, all cracks, openings, splits, and similar imperfections are completely filled and sealed as the expanding urethane foam reaction is completed; the liquid-to-solid expansion property also enables it to be self-flashing, which generally eliminates the need for metal counterflashing, masonry reglets, and wood or metal cants, and; it can be placed in variable thicknesses to provide improved drainage.

A complete coverage of the principles and practices of PUF application and maintenance cannot be included here, but some of the fears associated with the system have been discussed and it has been shown that the industry, materials, equipment and people have progressed over the years to the point where a good PUF roofing system can be gotten at any Naval installation in any climate.

Examples of very effective PUF installations may be seen at Naval installations at Clifton, NJ; Roosevelt Roads, PR; Cape Hatteras, NC; Indianapolis, IN; Subic Bay, RP; and Philadelphia, PA.

The Naval Civil Engineering Laboratory has done extensive testing of the various systems. A NAVFAC guide specification is available on Silicone Coatings and a new guide specification is to be released on "Sprayed Polyurethane Foam for Roofing Systems." Guide specifications are also being planned to cover other elastomeric coating systems which have been shown to perform in a superior manner. A basic discussion of PUF roof systems and their application may be found in a publication by Keith H. Coultrap entitled *Principles of Urethane Foam Roof Application*, PO No. 79-MR-461 (Naval Civil Engineering Laboratory, June 1980). □

we're cracking down on

Energy Waste

with centralized energy monitoring and control systems

EMCS operator Jan Thompson expresses satisfaction upon remotely applying a new energy control loop to an existing building system.

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Prior to the 1973 energy crisis, the Naval Air Station (NAS) at Whidbey Island, like most Naval and civilian energy consumers, was not very energy conservation conscious. Prior to 1975 the majority of station buildings were heated thermostatically or manually 24 hours a day. No form of night-setback or system shutdown was used. Fossil fuel shortages and rising energy costs forced the Navy to look for better methods to manage energy consumption. Between 1975 and 1979 individual time clocks were installed on many station building systems; however, the labor intensive manual control and system checks were still predominant. Response to system breakdowns was slow and often costly.

The development of various forms of energy management systems in the civilian market prompted station Public Works Department personnel to request that a centralized energy monitoring and control system (EMCS) be designed and constructed for NAS Whidbey.

Following an October 1974 project submission, Western Division, Naval Facilities Engineering Command (WESTDIV), developed the initial system requirements based on inputs from the station, an A/E consultant, NAVELEX, and WESTDIV design division personnel. These requirements included many of the considerations contained in the evolving navy EMCS guide specification.

Johnson Controls, Inc., of Milwaukee, Wisconsin, was awarded the three-site construction contract in June of 1978. Installation of field equipment began early and central control room equipment began arriving in January 1980 following extensive factory testing. Contractor-provided training sessions commenced in June 1980 and the 30-day acceptance test took place during February 1981. Final acceptance of the field equipment and central control room hardware occurred in March 1981 and acceptance of the complete software package occurred in June 1981. The EMCS acquisition cost was $772,000.

DESCRIPTION AND LAYOUT

The EMCS at NAS Whidbey Island is a Johnson Controls, Inc., Model JC-84. It is basically a Johnson JC-80 system enhanced to meet Navy specifications.

The central processing units consist of a Data General Eclipse S/130 mini-computer, a DG Micro Nova MP/100 back-up micro computer, a DG model 6045 10 megabyte disk drive, and a DG model 6026 magnetic tape drive.

Peripherals consist of a Hazeltine 1500 keyboard and cathode ray tube as operator's console, a Printoronix 300-line printer as alarm and report printer, an intercolor 8001G color CRT for field systems graphic displays and backup operator's console, a Texas Instrument Model 743 data terminal for primary computer foreground operation and backup computer operator's console, a Chrono-Log digital calendar clock, and a Digital Equipment Corporation LA-120 and LA-36 teletypes as remote consoles.

Field interface devices (FID) are linked to the central processing unit via a 16-channel UDS RM-16D multiple modem communications interface and the Navy-owned telephone cable network. As many as 63 separately addressable FIDs may be linked on each communication line.

Functional design configuration of the EMCS Central Control Cabinet is explained by system engineer Keith Kuenzi (left). Electronic mechanic Charles Triloff performs preventative maintenance voltage calibrations on one of 52 field interface devices. (right)

Each FID is capable of monitoring a maximum of 48 binary or 24 analog points, or controlling 24 start/stop relays or 24 analog reset points.

CAPABILITIES

The JC-84 system provides for energy management through a number of specific features. The binary and analog point monitoring and alarming feature provides for continuous status checks of the intended conditions of motors, tank levels, temperatures, set-points, humidities, and pressures.

Equipment operation and control system set-points are stopped, started, or adjusted on a fixed schedule, or if certain environmental or other conditions warrant, on a variable schedule of optimum energy management.

Unlimited system interlock design and application capability exists by use of multiple "if, then" logic and arithmetic calculations based on the status of any numer of point values.

Duty cycling of electrical or steam loads is accomplished either on a fixed schedule or variable according to actual environmental changes. EMCS can be used for shedding of additional loads as the station electrical or steam supply approaches any selected limits and aids in limiting electrical demand billing charges and reducing steam generation requirements. Optimal control of major heating and cooling systems for energy efficiency is available.

As an aid to the operation and programming of the specific applications, the above mentioned system capabilities, 22 separate reports may be generated to indicate current point status, assigned schedules, interlock logic, equipment run-time totals, analog point-value trends and totals by minute, hour, day, week, month, or year, and meter statistics, as well as EMCS hardware, software and network status. The ability to generate and apply these reports is essential to successful energy management.

Presently at NAS Whidbey, seven channels link 52 FIDs in 44 separate facilities, monitoring or controlling a total of 647 points; 299 are binary, 196 analog, 155 start/stop, 12 reset, 23 additional points are created from arithmetical or logical combinations of connected points. Current hardware can handle approximately 2,000 points.

OPERATIONS

The NAS Whidbey Island EMCS is used as a primary tool by the Public Works Department Engineering and Utilities Divisions to manage a base-wide facilities energy management.

Eight to sixteen hours per week of a GS-11 utilities/energy conservation engineer's time are directed toward system feature applications programming using existing field sensor and control points, development and/or design of field equipment additions projects, training EMCS-involved personnel, diagnosing problems, and contractor liaison.

Routine system monitoring, alarm response dispatching, schedule change input, and computer room equipment maintenance are performed by the Utilities Division secretary during the day shift. Evenings, nights, and weekends, system command control is shifted to a teletype at the central heating plant where EMCS-trained boiler operators monitor the system and respond or dispatch following alarms.

ENERGY SAVINGS

Approximately half of the facilities on the NAS Whidbey EMCS receive electricity and steam unmetered. Energy consumption accounting for these facilities is therefore estimated based on many factors: size, construction, occupation, equipment, etc. The quantification of electrical conservation within metered facilities is clouded by the increasing quantity of electrical equipment being installed. The total station electrical consumption has increased 2% during this past year.

Energy consumed for space heating, natural gas and fuel oil predominantly, are somewhat easier to quantify. Most new facilities constructed at NAS Whidbey Island since 1975 have included condensate meters. Older facilities have not changed significantly with respect to size, hours of operation, or room temperatures.

EMCS control is by far the most flexible and reliable form. If one looks at the fueloil consuption since FY73 of six 1942-era, cast-iron boilers, a gradual but continual decrease in heating energy consumption is noted. Local time clocks were added between 1974 and 1977, attic insulation installed in late 1976 and EMCS brought on line during FY81. The EMCS is felt to have contributed significantly to the 14% reduction in consumption per degree-day since the previous year.

Similarly, natural gas consumption by three fairly new boilers indicate a 16% reduction in therms per degree-day during this past October to March heating season. This represents 766 MBtu saved annually. For the natural gas fired central heating plant, after backing out the steam consumption of a new aircraft maintenance hangar connected last year, a 6% reduction representing 16,440 MBtu saved per year was achieved.

At current energy costs of $1.37 per gallon of #2 fuel oil and $.52 per therm of natural gas, the 18,481 MBtu total savings accounted for under the three previous examples represents an annual dollar savings of approximately $102,000. Assuming similar percentages of energy savings are being attained within the many unmetered EMCS interfaced utility systems and facilities, a total annual energy savings of 42,000 MBtu is probable. □

RECALL TO ACTIVE DUTY - The Civil Engineer Corps has limited openings each year for officers to be recalled to active duty. The criteria for recall are based on age, professional qualifications, and service needs. Generally, the Civil Engineer Corps seeks officers in the ranks of Lieutenant and Lieutenant (junior grade) for recall. Reserve officers on inactive duty who desire voluntary extended active duty may submit an application for recall to extended active duty, NAVPERS Form 1331/5, directly to the Chief of Naval Personnel or contact the CEC Detail Officer (AC 202 694-3635/6) for additional information.

(NAVFAC Code 09M)

UEPH STANDARD DESIGN - In the FY 1983 Military Construction Authorization Act, the Conferees of the Combined Armed Services Committee directed that the Secretary of Defense select a standard design for permanent party barracks for all services and apply that standard to all future projects. Currently, there are still many issues to be resolved on the application of the directive. NAVFAC has a representative who is in contact with OSD and is representing the Navy's position. Each Engineering Field Division has been directed to continue design on all UEPH projects in the FY84 program. All UEPH designs for FY85 have been placed on hold until the decision is made on how to proceed.

(NAVFAC Code 051)

FY82 NMCB FLEET BEST OF TYPE/BATTLE "E" WINNERS

Congratulations to the officers and men of NMCBs FORTY and ONE THIRTY-THREE, who were announced as the Pacific and Atlantic Fleets FY82 NMCB Best of Type/Battle "E" Winners, respectively. NMCB FORTY was selected for their excellent performance while deployed to Guam and superior achievements while in homeport. NMCB ONE THIRTY-THREE was commended for superior management of a highly effective homeport training period and the finest, best balanced European deployment in recent memory. Competition was tight and the two winners now compete for the prestigious Society of American Military Engineers Peltier Award which recognizes the most outstanding NMCB during the prior fiscal year.

(NAVFAC Code 0631)

Carelessly stored waste may be hazardous to your health

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The establishment of the Resource Conservation and Recovery Act (RCRA) is a major step in improving our health and our environment. Because of this act, generators of hazardous waste are now bound by law to ensure its proper disposal. The law also requires proper storage, labeling and transportation of the hazardous waste. Even though training is required by the many new people involved, some do not fully understand the dangers of working with hazardous waste. Perhaps the most dangerous phase occurs during storage. This usually takes place at a hazardous waste transfer facility.

Hazardous waste from ships, contractors and numerous activities accumulates at the facility. It is important to recognize that hazardous waste generated on a government installation is the responsibility of that installation. The responsibility of the facility is to identify, label, store, and prepare the hazardous waste for ultimate disposal. This doesn't sound too difficult, but it must be recognized that hazardous waste seldom arrives in neatly labeled containers. Most of it arrives in a deteriorated condition. Consequently, problems and dangers arise.

Personnel working with hazardous waste may find themselves in the midst of hundreds of containers of different chemicals. Some containers are ready to collapse and spill their contents while others are leaking. Many containers are not labeled, or, even worse, labeled incorrectly. Some hazardous waste arrives "premixed." The aged condition of the hazardous waste also presents hazards. The inherent dangers of hazardous waste will always be present, i.e., flammability, toxicity, corrosivity; however, these conditions can be reduced or eliminated. In other words, hazardous waste will be less hazardous if it is properly managed.

DETERIORATED CONTAINERS

Deteriorated containers are usually in abundant supply, and will vary in size from one pint to 55 gallons. Corrosion and physical damage are the major problems. Much of the corrosion is caused by exposure to the weather. Rust causes leaks from the top, sides, and/or bottoms of the containers. Sometimes placing one five-gallon container on top of another will cause the sides of the bottom container to burst open due to its corroded condition.

In one case, four drums of trichloroethylene (TCL) were in such poor condition they could not be moved. A chemical pump was then used to transfer the TCL into new drums. Dents in containers not only weaken the metal, but also accelerate its corrosion due to increased stress. Incoming containers should be carefully examined for signs of deterioration. Transfer the contents to new containers when required.

When transferring contents ensure that chemicals and containers are compatible. Glass containers are subject to corrosion from hydrofluoric acid (HF). In one case the bottom fell out of a sampling bottle due to corrosion by the HF. The HF is sometimes accidentally produced during a reaction. Stainless steel containers can also be corroded by mixtures of chlorinated solvents and tetrahydrofuran (THF).

LEAKING CONTAINERS

Leaking containers of sulfuric acid (SFA), also known as instant banana peel, have caused handlers to slip and fall in the acid. Leaking containers also generate organic vapors, most of which are heavier than air. Vapors can travel a considerable distance to a source of ignition. Static electricity, steam pipes, light bulbs, and sunlight are potential sources of ignition.

Another danger of leaking containers is contact between incompatible chemicals. This contact may result in fires, explosions, and/or release of toxic gases. The worker then faces the danger of being caught in a deadly flashback or explosion. This is why hazardous wastes should be separated with dikes, sumps, or other means.

It is important to note that hazardous waste must never be stored alphabetically or in categories. The correct method is to "store by compatibility," i.e., store chromic and ni-

Peroxidized Ether

Wrong Label; Actual Contents — Mercuric Nitrate

Dented Cans of MEK

tric acids with inorganic corrosive "oxidizers."

A safety note describes the results of two incompatible hazardous materials contacting each other aboard a CVA. A fire resulted in which eight men died and sixteen others were injured.

UNLABELED CONTAINERS

Many containers have rusted exteriors and are totally devoid of identification. They are usually referred to as mystery drums or bottles. Litmus paper and/or flammability tests cannot determine the chemicals involved. Tests will only determine the compatibility of the compound. In other words, just because a litmus test indicates an acid, the compound should not be mixed with any other acid! A powerful reaction or explosion could result.

All acids are not compatible. An accurate laboratory analysis should be used on all unlabeled containers, regardless of size. These unlabeled containers should always be kept outside of the facility until the laboratory has provided positive identification. It is also advisable to store them out of direct sunlight if possible.

INCORRECT LABELS

Incorrect labels are one of the most dangerous hazards encountered in handling hazardous waste. For example, if a bottle labeled "nitric acid" is received and, in order to compact shipments, the contents is poured into a five-gallon container that does not actually contain nitric acid but an incompatible acid instead, an explosion could be the result.

In other cases, flammable or toxic gasses may be generated. If an incorrectly labeled container of ferrocyanide (source: reproduction equipment) was added to an acid, toxic cyanide gas would be generated.

The hazardous waste worker is subjected to unnecessary risks when the waste is incorrectly labeled. When labels on containers of hazardous waste can't be trusted, lives may be in jeopardy.

MIXED WASTE

Some hazardous waste arrives in a mixed or contaminated condition, and may already be in a dangerous condition. If combinations of oxidizers and reducers exist, a fire or explosion could result at any time. There are hundreds of combinations of chemicals that will result in fires and/or explosions. Some of the mixtures can even qualify as military high explosives. Untrained persons are not always aware of the grave consequences involved when hazardous wastes are mixed.

In one case which occurred in 1978, a young truck driver drove his truck to a state licensed waste disposal pit in Louisiana. He then began discharging the contents of his tank truck into the pit. The chemical reaction which followed generated toxic vapors. He died within a few seconds from inhaling the toxic vapors. Although waste pits are not legal today, the mixing of hazardous wastes still occurs.

AGING

Aging can result in detrimental effects to chemicals. For instance, an aging bottle of ether can form explosive peroxides. Moving or opening a peroxidized can or bottle can result in a violent explosion. Take extreme caution when handling compounds which can form peroxides. Users should discard stock as the manufacturer suggests. Inhibitors will not prevent peroxide formation indefinitely. If there is a possibility of explosive peroxides, the container should not be moved or touched. The local Explosive Ordnance Disposal (E.O.D.) Group should be contacted. They have been trained to neutralize such hazards.

SAFETY FIRST

It is standard Government policy to provide workers with protective clothing and equipment to protect against hazards, i.e., respirators, goggles. Safety equipment can provide complete protection against the hazards of the six conditions, however, and workers should be made to understand the insidious nature of hazardous waste. They must realize that exposure comes from just being in the vicinity. This is because safety equipment can only provide "marginal" protection.

The six conditions are primarily the result of improper management of hazardous materials.

Every worker involved with hazardous materials/waste should be thoroughly trained. This includes everyone from the people who place the order to those who process the waste. At the minimum, training should include classwork in elementary chemistry, laboratory safety, and hazardous waste regulations; also fieldwork in identification, storage, and use and handling. Training, however, will not prove to be a panacea. The transient nature of both service personnel and contractors will continue to result in dangerous conditions of hazardous waste. Hazardous waste is hazardous because of its flammability, corrosivity, toxicity and reactivity. Untrained personnel who generate the waste should not be allowed to make it even more hazardous. □

Deteriorated Unlabeled Nitric Acid Container

Unlabeled Drums

Leaking Paint Containers

reader's comments/questions

departments

ON GARCIA IN 1971

I just finished reading the articles on Diego Garcia in the Navy Civil Engineer, Spring 1982. They were very interesting. I was with the first main deployment party of NMCB-40 in early 1971.

Would you be able to help me find any articles or persons that have knowledge of the progress of Diego Garcia? Any help would be greatly appreciated. Also, on page 29 of the Spring 1982 issue, there was an article mentioned that was authored by JO3 Dave Robson about NMCB-40 and that was published in the Summer 1981 issue. May I have a copy of the edition?

Gerald K. Olson
Tour of duty May '68 to Feb '72 (NMCB-40)
West Fargo, ND

Thank you for writing. I'm glad you enjoyed the articles about Diego Garcia. By now your should have received "PacFacs" that I forwarded to you and was full of information about Diego Garcia. Also enclosed was the Summer 1981 issue of TNCE you requested.

NICE WORDS

Rear Admiral Zobel's article, "Command Management Plan Guidance," was very well written. It's nice to see such clear thinking and practical guildlines from the top of the Civil Engineer Corps family.

Joy Erdman
Naval Energy and Environmental Support Activity
Port Hueneme, Calif.

We're glad you liked the article and thank you for writing and telling us. Reader feedback is the next best thing to Christmas for editors.

BETTER LATE THAN NEVER

I want to compliment you on the summer 1982 edition of the Navy Civil Engineer. Although it maintained its tradition of being late, it truly now is "better late than never!"

I found this edition very professional as always, but with a new positive focus on the Civil Engineer Corps as a desirable, interesting, people-oriented career. The articles on CEC jobs and unusual officer activities portray the type of life attractive to potential CEC officers. A series of similar articles would be of interest to CEC officers as well as other readers.

Congratulations again on your excellent work.

CDR John P. Collins
OIC, NEESA
Port Hueneme, Calif.

Thank you for writing and for your nice words. I hope we can continue to relate stories about unusual deployments and assignments. Whether we do or don't depends upon the interest and submissions of our faithful contributors which so far have been excellent. If you know of someone who has a good story to tell, please direct them our way! Yes, I caught that about "better late than never," and you're right — we are a tad late, but it's only temporary. We should be back on the track in the next issue or two. Thanks again Commander!

MANUSCRIPTS ARE WELCOME

Contributions, comments and criticisms from readers are welcomed. Original manuscripts are particularly invited. Opinions or suppositions expressed by authors are solely their own and do not necessarily reflect command or official concurrence. An inquiry should be directed to the Editor prior to submission of material to prevent duplication and to aid in publication planning. The Editor reserves the right to condense accepted material or to complete alterations without author consultation. Material appearing in The Navy Civil Engineer *may be reproduced. It is recommended that prior to reproduction an inquiry be made to the Editor for additional data that may have become available.*

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Manuscripts for editorial consideration and inquiries should be directed to the Editor at the publication offices, address listed below:

Editor, Navy Civil Engineer Magazine
CECOS, Code C20M
Port Hueneme, Calif. 93043

WANT TO REQUEST DOCUMENTS FROM ARTICLE ON PAGE 19?

Requests for these documents and glossaries, and further detailed instructions as to their operation, may be obtained by sending an eight-inch WP diskette for return transfer. Requests should be directed to:

Lt G. T. Frentz, Code 06
Officer In Charge of Construction
Naval Facilities Engineering Command Contracts, Diego Garcia
11111 Richmond Avenue, Suite 310
Houston, Texas 77082

For commands having word processing telecommunications capability, these documents are available to be transmitted at 4800 BAUD through a "208B" modem by contacting (713) 780-0031. Coordination or other questions can be handled by contacting LT Frentz at (713) 780-6332.

26 new officers complete special training at CECOS

Twenty six new officers joined the ranks of the U.S. Navy's Civil Engineer Corps on June 11, 1982 upon their graduation from the Naval School, Civil Engineers Corps Officers, Port Hueneme, Calif., and have accepted assignments all over the world.

The class, Number 163, completed eight weeks of specialized training pertinent to the Navy's needs for shore installation engineering, public works management, and Seabee operations.

Four graduated with honors:

LT Arthur D. Ayars, Jr.
Outstanding Graduate

LTJG Calvin C. Hicks
With Distinction

CW02 Thomas E. Linenberger
With Distinction

ENS Thomas C. Sheahan
With Distinction

LT Ayars' photograph is indicated by (•). Students graduating with distinction are indicated by (·) and those entering Seabee duty by (†).

• **LT Arthur D. Ayars, Jr.**
BS Sys. Eng./USNA
to Jacksonville, Fla.

ENS Michael C. Benson
BSCE/Ark. U.
to Millington, Tenn.

LT William T. Bersson
BSCE/Va. Mil. Inst.
to Norfolk, Va.

ENS James A. Bolling
BSCE/Fla. U.
to New Orleans, La.

LTJG Elizabeth A. Clarkson
BIE/Ga. Inst. of Tech.
to Pearl Harbor, Hawaii

ENS David M. Coleman
BSCE/Tex. A&M
to San Diego, Calif.

† **LT Sean G. Corrigan**
BSCE/Rensselaer Poly. Inst.
to Port Hueneme, Calif.

ENS William A. Davidson
BSCE/Hawaii U.
to Stockton, Calif.

ENS David P. Dinwiddie
BSEE/Rose-Hulman Inst.
to Guam, M.I.

ENS Michael L. Dowdy
BSCE/Texas A&M
to Monterey, Calif.

ENS William L. Gardner
BSME/Texas U.
to Yokosuka, Japan

ENS Janet L. Greenbaum
BSEE/Miami U.
to Jacksonville, Fla.

• **LTJG Calvin C. Hicks**
BSCE/Kansas U.
to Great Lakes, Ill.

LT Jerry G. Howell
BSIE/Tenn. U.
to Gulfport, Miss.

• **CWO2 Thomas R. Linenberger**
to Gulfport, Miss.

† **ENS Kenneth A. Lueth**
BSCE/N.J. Inst. of Tech.
to Port Hueneme, Calif.

LT. Gary R. Minck
MSCE/Marquette U.
to Long Beach, Calif.

ENS Joseph A. Monachino
BSEE/Missouri U.
to Pensacola, Fla.

† **LT Grady J. Pennell, Jr.**
BS Ag. Eng. Texas A&M
to Port Hueneme, Calif.

† **ENS Hans Probst, Jr.**
BSCE/Kentucky U.
to Gulfport, Miss.

ENS Kevin E. Putman
BSCE/Ohio State
to Norfolk, Va.

†• **ENS Thomas C. Sheahan**
BSCE/Union Coll.
to Gulfport, Miss.

ENS Timothy M. Smith
BSCE/Clarkson U.
to Keflavik, Iceland

† **LT Michael D. Thornton**
BA Arch./Iowa State
to Port Hueneme, Calif.

ENS Lewie J. Wallace
BSCE/Ark. U.
to Point Mugu, Calif.

ENS Joseph L. Woody
BSCE/Purdue U.
to San Diego, Calif.

Navy civilians "suit up" for crucial jobs

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Engineering students see inside covers for information about careers in the U.S. Navy